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100 parts SBR polymer
75 parts SRF black
17.5 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8675
100 parts SBR polymer
50 parts HAF black
9 parts naphthenic processing oil
rosin/staining

BAYTOWN 8676
100 parts SBR polymer
50 parts ISAF black
10 parts aromatic processing oil
rosin/staining

BAYTOWN 8677
100 parts SBR polymer
52 parts HAF black
10 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8678
100 parts SBR polymer
40 parts SAF black
5 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8679
100 part SBR polymer
40 parts SAF black
10 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8680
100 parts SBR polymer
52 parts HAF black
15 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8681
100 parts SBR polymer
50 parts ISAF black
15 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8775
100 parts SBR polymer
75 parts HAF black
37.5 parts aromatic extending oil
mixed/staining

BAYTOWN 8776
100 parts SBR polymer
50 parts HAF black
37.5 parts naphthenic extending oil
mixed/non-staining

BAYTOWN 8777
100 parts SBR polymer
75 parts HAF black
37.5 parts naphthenic extending oil
mixed/non-staining

BAYTOWN 8778
100 parts SBR polymer
75 parts HAF black
37.5 parts highly aromatic extending oil
12.5 parts highly aromatic processing oil
mixed/staining

BAYTOWN 8779
100 parts SBR polymer
75 parts HAF black
37.5 parts naphthenic extending oil
12.5 parts naphthenic processing oil
mixed/non-staining

BAYTOWN 8780
100 parts SBR polymer
71.5 parts HAF black
51.25 parts aromatic extending oil
mixed/staining

BAYTOWN 8781
100 parts SBR polymer
55 parts ISAF black
37.5 parts aromatic extending oil
mixed/staining

BAYTOWN 8782
100 parts SBR polymer
68.75 parts FEF black
37.5 parts naphthenic extending oil
mixed/non-staining

BAYTOWN 8783
100 parts SBR polymer
80 parts FEF black
37.5 parts naphthenic extending oil
mixed/non-staining

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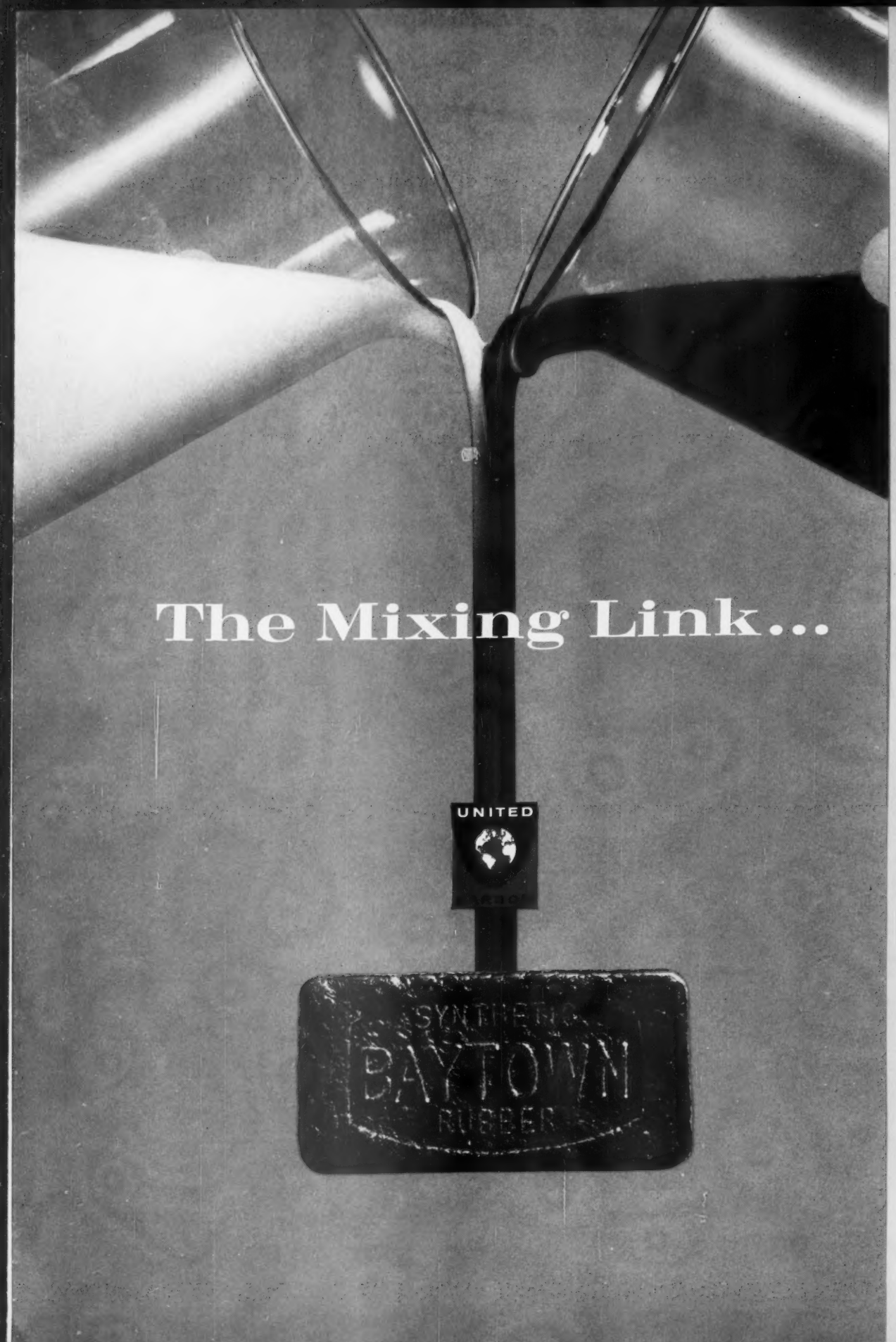
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Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

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Highlights Sidelights *of the News . . .*

November, 1960

Official registration at the Second International Synthetic Rubber Symposium held in London on October 11-13 was 800 including 120 persons from various countries . . . The meeting featured the presentation of 19 technical papers and an International Rubber Exhibit (page 306).

The International Rubber Conference sponsored by the German Rubber Society on October 4 to 8 in West Berlin, was said to be the largest conference on rubber chemistry and technology ever held in Europe . . . Official registration was set at 1,029 . . . Some 70 U.S. representatives were in attendance (page 316).

Over 250 delegates from all over the world attended the Natural Rubber Research Conference held on September 26 to October 1 at the headquarters of the Rubber Research Institute of Malaya in Kuala Lumpur . . . The conference stressed the Malayan natural rubber industry's expanded research and development program (page 322).

A rubber industry exhibit featured the 43rd National Automobile Show held on October 12-23 in Detroit, Mich. . . . The rubber industry joined some 100 other suppliers in demonstrating their products to the automobile industry (page 325).

George R. Vila has been elected president of the U.S. Rubber Co. succeeding John W. McGovern, who has retired after 40 years with the company . . . Mr. Vila was formerly an executive vice-president of the company responsible for the operations of the company's Naugatuck Chemical, Textile and International Divisions (page 342).

The International Rubber Quality and Packing Conference held in Singapore in September decided to eliminate twelve overlapping RMA and Singapore grades and substitute ten new international grades . . . An international sampling committee was also agreed upon (page 320).

The International Rubber Study Group estimates that 3.89 million long tons of new rubber will be consumed in the world in 1960 . . . IRSG expects that 2,070,000 long tons of natural and 1,770,000 long tons of synthetic will be consumed (page 315).

Over 200 persons attended the October 9-11 meeting of the Rubber and Plastics Division, A.S.M.E. in Erie, Penna. . . . This was the first division meeting held independently from the parent society (page 326).

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HUBER'S AROMEX HAF
HUBER'S AROMEX CF
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METHYL THIRAM

(tetraMETHYLthiuram Disulfide)

Pennsalt

ETHYL THIRAM

(tetraETHYLthiuram Disulfide)

Hevea	PHR Thiram	T-5 @244°F	Cure Time @280°F	M300	T	T-5 @244°F	Cure Time @280°F	M300	T
no sulfur	3.0	6.3	12½	1425	2950	9.8	25	1175	2875
low sulfur	1.0	10.6	10	1850	3375	19.4	12½	1425	3125
high sulfur	0.3	18.4	10	1800	3125	27.7	12½	1675	3150

SBR 1500	PHR Thiram	T-5 @262°F	Cure Time @298°F	M300	T	T-5 @262°F	Cure Time @298°F	M300	T
no sulfur	3.0	9.2	15	925	2900	17.7	15	625	2275
normal sulfur	0.5	13.6	20	1900	2750	19.4	25	1625	2850
normal sulfur	0.7	13.0	20	2125	2450	14.8	25	1825	2700

Nitrile	PHR Thiram	T-5 @262°F	Cure Time @320°F	M500	T	T-5 @262°F	Cure Time @320°F	M500	T
no sulfur	2.0	20.7	7½	1025	2275	23.5	7½	950	2100
normal sulfur	1.0	21.7	7½	1050	2125	23.1	7½	1075	2175

See our complete listing in Chemical Materials Catalog

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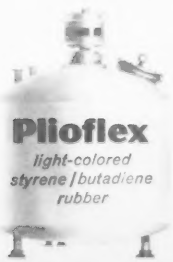
Photograph taken with the cooperation of Rubbermaid Inc., Wooster, Ohio.

They're knee-deep in selling points—thanks to PLIOFLEX

A big problem in manufacturing rubber kneeling pads is getting the right physical properties—every time.

The best answer one leading manufacturer found was to use PLIOFLEX 1510. It makes possible a more uniform open-cell structure, better tear strength, and generally superior product quality—*batch after batch.* Just as important, PLIOFLEX 1510 reduces sticking and permits a lower temperature cure during molding. And uncured trim scrap can be effectively reworked, further cutting processing costs.

If you're looking for ways to improve your product—and profit-picture—look closely at PLIOFLEX 1510. For technical details on "1510," or for assistance with your specific problem, just write to Goodyear, Chemical Division, Dept. W-9419, Akron 16, Ohio.



Lots of good things come from

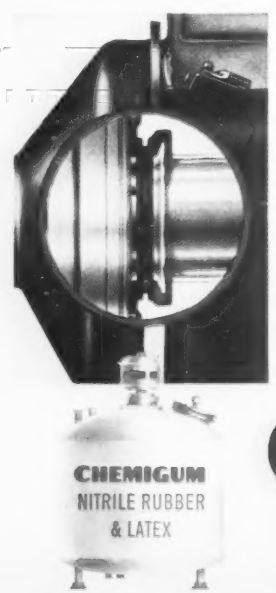
GOODYEAR

CHEMICAL DIVISION

Plioflex—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Photographs taken through the cooperation of Brummer Seal Co., Chicago Heights, Illinois

Another "seal of approval"—won with CHEMIGUM!



A long-time problem to automotive engineers and designers was the leaking of oil from rear main bearings. Seals of leather, fiber, metals and other materials just didn't do the right job.

Exhaustive study by a leading manufacturer led to a series of specially designed seals made with CHEMIGUM. CHEMIGUM was chosen because of its outstanding resistance to oil and heat, its toughness and abrasion-resistance and its processability that permitted easy production of smooth, close-tolerance, tight-sealing rings.

Thoroughly proved on the test rack and the test track, these seals of CHEMIGUM have won the approval of a number of manufacturers—are now at work on over a million automobiles. How can CHEMIGUM help your product win similar acceptance? For details write Goodyear, Chemical Division, Dept. W-9419, Akron 16, Ohio.

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Chemigum—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Photograph taken through the cooperation of Acushnet Process Company, New Bedford, Mass.

WING-STAY 100 checks the effects of oxygen—and ozone

It's no easy task to develop a good brake cylinder boot compound.

Part of the problem is the frequent flexing under exposure to hydraulic fluid and heat. But equally important are the effects of oxygen and ozone degradation.

A happy solution was found by one leading manufacturer in the form of WING-STAY 100. This triple-action chemical (stabilizer, antioxidant *and* antiozonant) proved most effective against atmospheric attack in extensive laboratory and field tests. Moreover, it displayed excellent processing qualities.

Why don't you look into the extra protection of WING-STAY 100? Full details, including the latest *Tech Book Bulletins*, are yours at Goodyear, Chemical Division, Dept. W-9419, Akron 16, Ohio.

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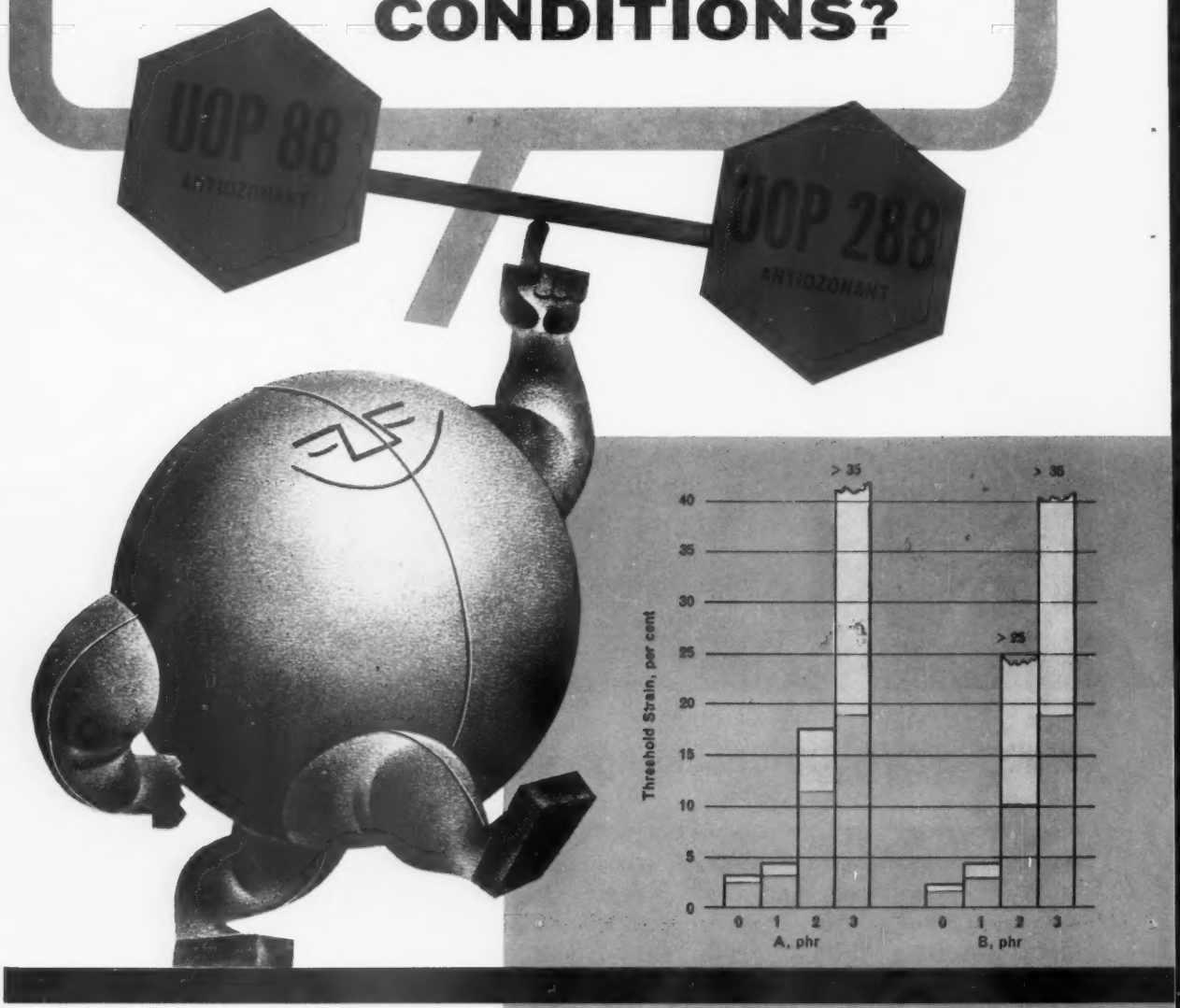
Wing-Stay—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

how can rubber be best protected against SEVERE OZONE CONDITIONS?



The two charts, above right, show results of tests made to determine antiozonant requirements of SBR stocks when subjected to stress at increasing ozone levels.

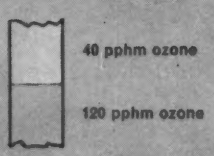


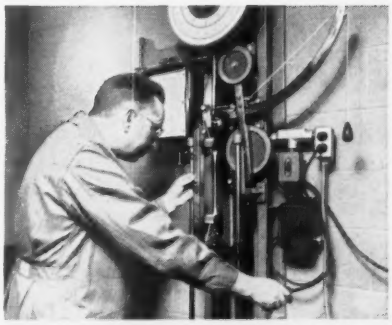
CHART A—Chart above shows effects of increasing antiozonant content of SBR stocks to meet increasing ozone level.

severe conditions of ozone and stress call for extra-special protection . . .

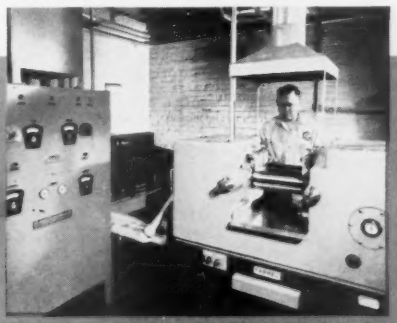
Smog which may contain up to 100 pphm ozone is hard on health and disposition. It is equally hard on rubber products. High ozone levels cause severe cracking in rubber formulations. In addition, stress also contributes to this problem as shown in Chart A, below left. How do you prevent such deterioration, assure long service life for your product under severest service conditions?

First, use antiozonants UOP 88 or 288, which offer maximum ozone protection. A relatively small loading of these low-cost antiozonants goes a long way in providing increased protection. Chart "B", for example, shows that 2 phr of antiozonant provides ample protection at an ozone concentration of 40 pphm, while an increase from 2 to 3 phr more than compensates for a 200% increase in ozone concentration.

Ozone concentration is but one of many factors to consider in manufacturing antiozonant-containing rubber products. Our staff of specialists, backed by UOP laboratory facilities and field experience, will be happy to discuss your problems with you. Simply write or telephone our Products Department.



Every day we test a number of rubber recipes. The Scott Tester is used to measure physical properties of an experimental vulcanizate.



To evaluate any service problem, test formulations are carefully compounded in this rubber mill by trained UOP technicians.

UOP ozone cabinets provide test conditions at a wide range of ozone concentrations.

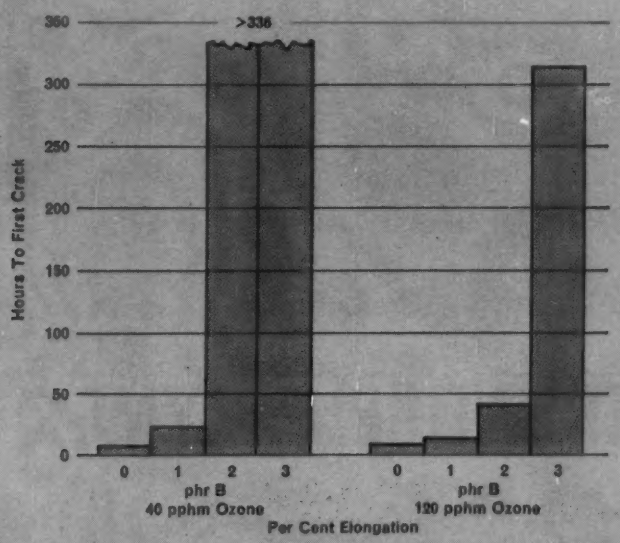


CHART B—Results of tests of two sets of samples containing varying amounts of antiozonants. Each were subjected to ozone concentrations of 40 pphm and 120 pphm. Note that an increase of 2 to 3 phr antiozonant proved adequate for the greatly increased ozone level.

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capitol cues

NO BIG ANTI-RECESSION PROGRAMS ARE BEING PLANNED now in Washington. The official line from the President on down is that business will stay good throughout the year. Until the contrary is crystal clear, officials will not even consider new programs for more spending. They fear budget deficits and renewed inflation. Besides, many feel the new President should make his own plans next year. For the time being, reliance is placed on easing of money.

> Treasury Secretary Anderson has summed up official thinking on business prospects: Having gone through an inventory shake-out, the economy is now cleared for growth. He sees no slide this year or during 1961. However, it is worth noting that this view is being vigorously disputed by many economists.
>
> A big group of economists is more impressed by the number of key indicators that are either standing still or heading down. This sluggishness, they feel, is a certain prelude to a slide either late this year or early in 1961. The pessimists don't see anything--such as a plant and equipment boom or increasing auto sales--coming along to push the economy off dead-center.
>
> Here are some of the declining indicators which they cite:
> -Capital spending topped out last quarter and now is dropping.
> -Inventory building is over and there may be some liquidation.
> -New orders have already begun to decline and are below 1959.
> -Industrial output, after months of stability, is declining.
> -Retail sales confounded expectations by falling last Summer.
> -Employment is leveling off and unemployment is on the rise.
> -Corporate profits won't even match those of strike-hit 1959.
> Admittedly, the declines have not been very great to date.

A BLUEPRINT FOR FIGHTING A DOWNTURN is quietly being drafted by some economic advisers for the Democratic Party. They, too, see no signs of the upturn forecast by Secretary Anderson and other officials. They feel that the next Administration should give top priority to such programs as federal aid for schools, help for depressed areas, slum clearance, higher unemployment benefits, and easier credit. And they don't rule out a tax cut for those in the lower brackets, though this would be held in reserve. They would let the federal budget run a deficit until they could be sure business is recovering.

CONSUMERS PLAN TO BUY FEWER DURABLE GOODS within the next six months, as compared with last Fall, according to a new government survey of 17,000 households. Only 3.0% of those surveyed plan to buy a new car; last October, the figure was 4.6%. Those expecting to purchase a used car within the next six months declined from 4.6% to 3.7%. Buying plans for appliances--TV sets, washing machines, and refrigerators--have decreased, too. These purchasing plans mean that merchants may have trouble this Fall in matching '59 sales.

CORPORATE PROFITS WON'T COME UP TO EXPECTATIONS this year. They're now running behind 1959 and the trend is still down. The main reason for the disappointing showing: the steady increase in costs of labor, supplies, transportation, and many overhead expenses.

capitol cues (cont'd)

THE BUDGET SURPLUS IS FADING RAPIDLY, say government fiscal officers. The President originally estimated spending for the 12 months ending June 30 at $80 billion and forecast revenues of about $84 billion--thus, a surplus of $4.2 billion. But, now, those early estimates appear to be too optimistic.

Here is the way the federal budget picture now shapes up:
-Spending will be up $600 million from prior estimates. The reasons? More defense spending, federal pay increases, etc.
-Revenues will be off $2.5 billion, because of lower profits.
Net, there will be a surplus of only about $1.1 billion, if that. The declining surplus dampens hopes for tax reduction.

PROSPECTS FOR AUTO SALES IN 1961 point up the so-so business outlook. Deliveries of both domestic and foreign cars seem likely to total 6 million. That will match the average of recent years but will run 700,000 under '60. And those who buy will go even stronger for small cars--40% instead of 30%. Not until 1962 is there likely to be another new surge in new-car sales.

Prices of 1961's will be about the same for most of the lines produced in this country. However, competitive pressure will be put on domestic makers by reductions in prices for foreign autos. This will produce a big scramble for sales next year.

NEW CHANGES IN THE SOCIAL SECURITY SYSTEM--carried in the law signed recently by the President--will give several big breaks to elderly retirees. Beneficiaries can earn more after retirement without losing their benefits. The old law took away payments from beneficiaries for one month for each $80 (or fraction thereof) that was earned over and above $1,200 in any one year. Now, the loss will be $1 for each $2 of earnings between $1,200 and $1,500. For income over $1,500, individuals will lose amounts equal to the excesses.

Two other important changes were made in the new law.
-Disability payments will begin with the employee's injury. Previously, the benefits couldn't start before the age of 50.
-Work requirements for full benefits now call for coverage in only a third of the quarters for 10 years--not for half.
If you want a fuller explanation, write the Gov't. Printing Office, Washington, D. C., for a copy of the booklet--"The Social Security Amendments of 1960". Cost is 5¢ per copy.

FOUR NEW GOVERNMENT PUBLICATIONS have just been issued which may be of interest to you. They cost little or nothing from various U.S. agencies.

-"Guides for Profit Planning" tells how to figure break-even points, gross margins, and rates of return on investment. It costs 25¢ from Gov't. Printing Office, Wash., 25, D. C.
-"The Power to Produce," the 1960 Agriculture Yearbook, tells about farm mechanization. It costs $2.25 from Government Printing Office. Your Congressman has some free copies.
-Eliminating price markdowns is discussed in Marketers' Aid 57, put out by Small Business Adm., Wash., D. C. It's free.
-Tax deductions from hurricane losses are detailed in a new Internal Revenue Service pamphlet. It's free from your IRS office. Ask for "Tax Treatment on Losses from Hurricanes."

Rubber industry enters new era as

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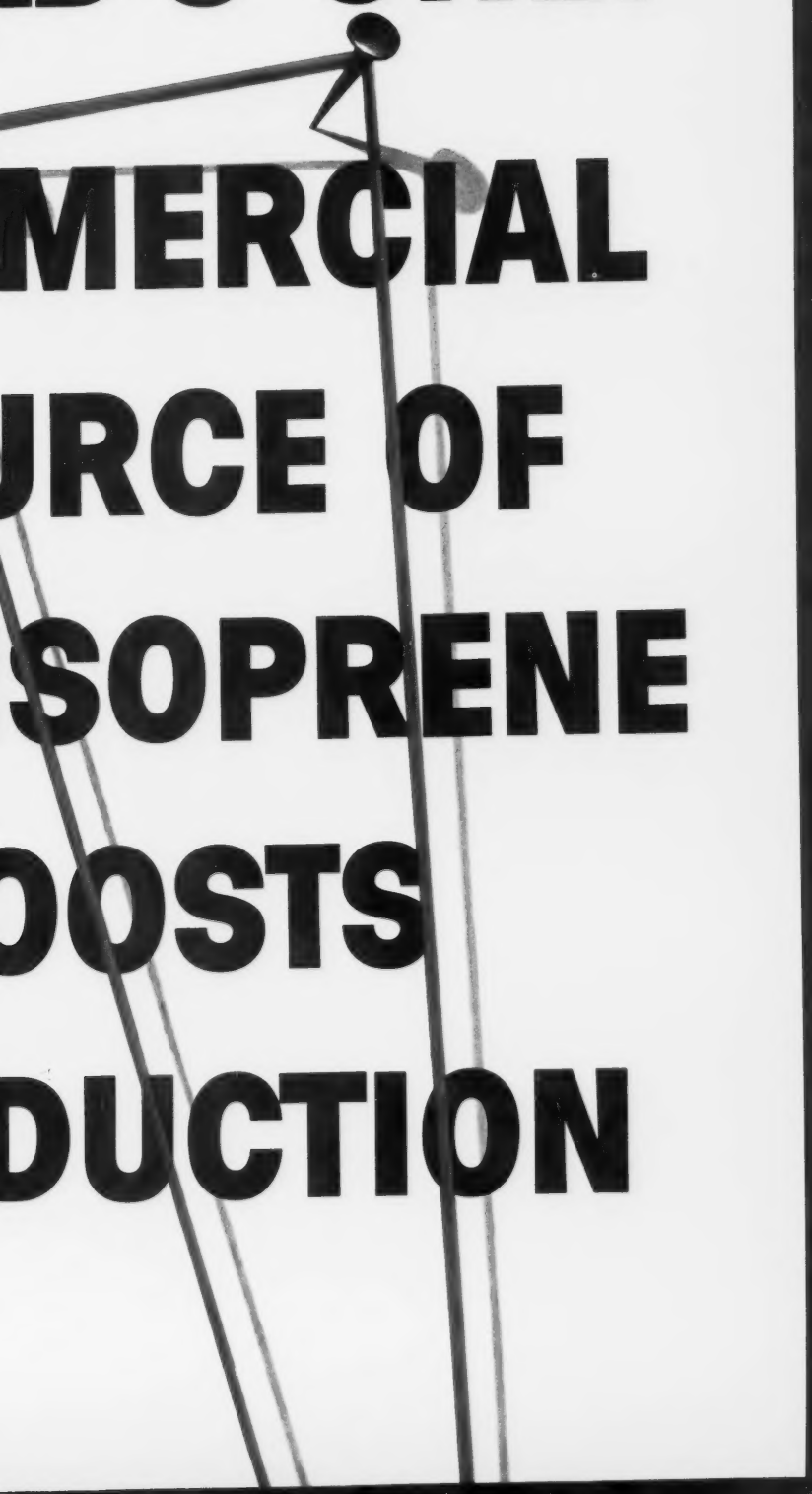

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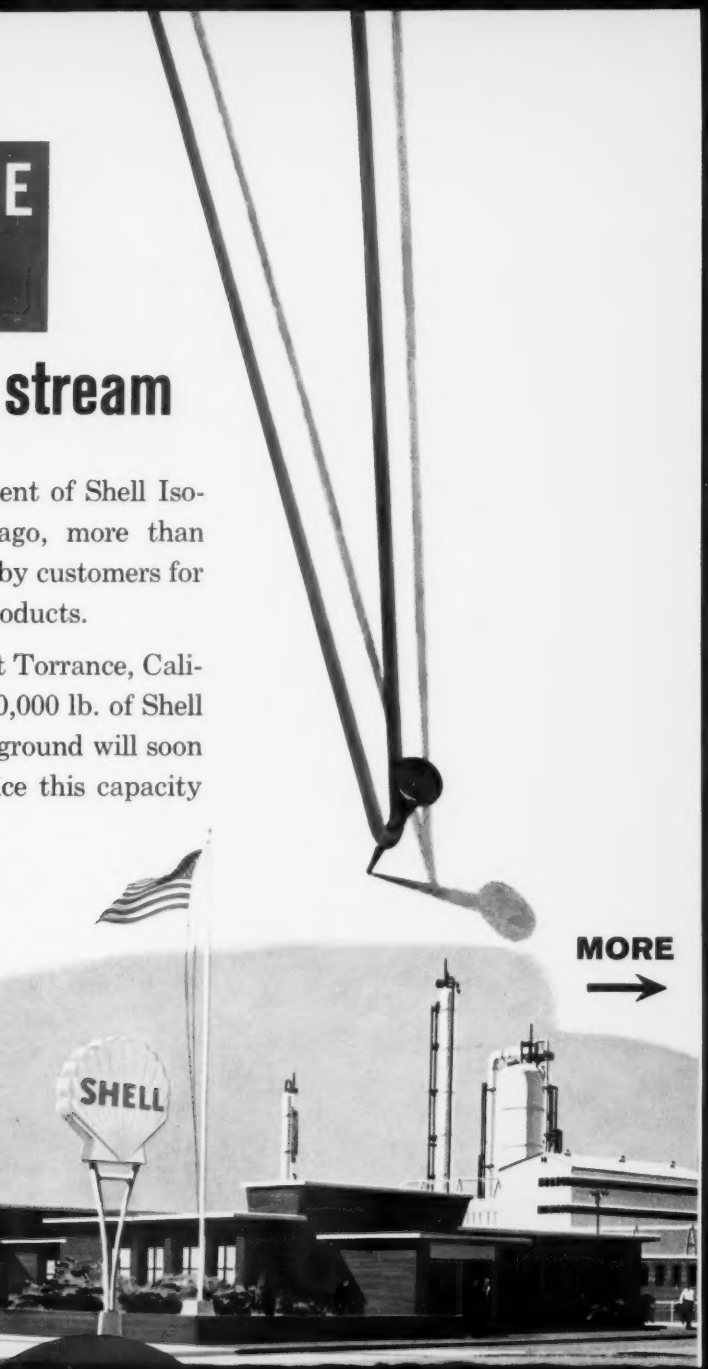
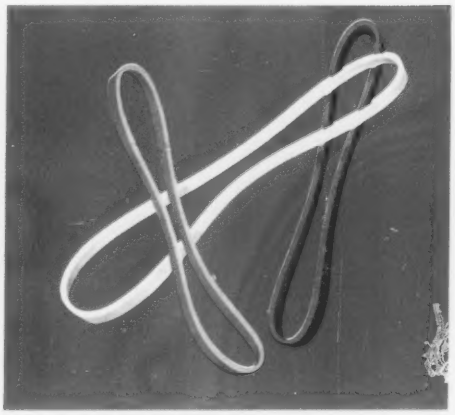


MORE

Let your Shell Technical Salesman show you how to take advantage of the outstanding properties of SHELL ISOPRENE RUBBER

IN MOLDED PRODUCTS . . . superior mold flow . . . improving detail, reducing rejects.



IN GUM STOCKS . . . light color, uniformity . . . especially important in light- and bright-colored products.

IN HEAVY-DUTY TIRES . . . low heat build-up, high resiliency and good mold flow . . . reducing blemishes and rejects.

IN PROOFED GOODS . . . flexibility, uniformity, excellent mold flow and high purity.

For more information about Shell Isoprene Rubber or any of Shell's general purpose SBR polymers and latices, call your nearest Shell Chemical office.

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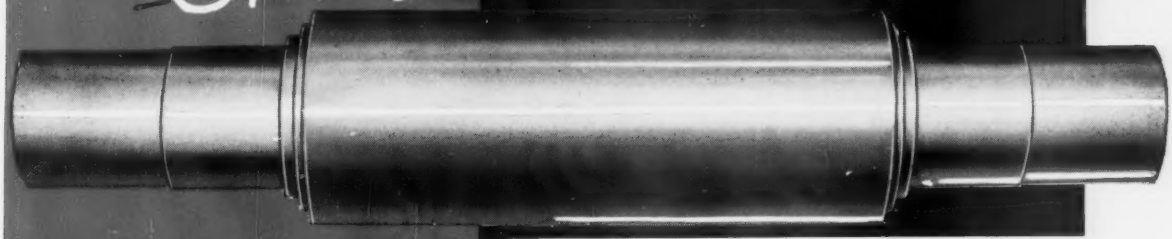

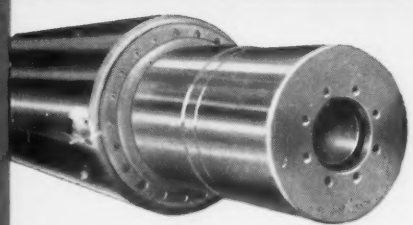

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or any materials requiring close heat control

Our more than 50 years' experience in the design and manufacture of rolls can be helpful in solving your processing problems. Your inquiry is solicited.

UNITED Precision Ground, DRILLED-TYPE ROLLS, the result of careful metallurgical control over raw materials, and of strict quality control in every phase of manufacture . . .

MAINTAIN A UNIFORM ROLL SURFACE TEMPERATURE throughout, with minimum deviation at any point.

ASSURE FULL RANGE HEATING and cooling over wide temperature ranges.

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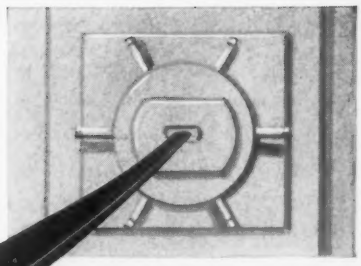
Jet®



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Use Gentro-Jet, General Tire's new steam-whipped black masterbatch, to get extra quality in tread rubber while enjoying amazing ease of manufacture. Gentro-Jet is available in a variety of compositions to meet every need. It's easy to handle, and eliminates mixing problems encountered when loose black is involved.

Gentro-Jet's high quality and superior dispersion is evidenced by its excellent die conformity . . . you get a better end product, plus easier, faster processing, all at a lower cost than with dry mix masterbatches.

GENTRO-JET BLACK MASTERS OFFER

- Easier, cleaner handling
- Faster processing
- Increased road wear
- High gloss, high density extrusions
- Economy in shipping, storage and handling

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CHEMICAL DIVISION • AKRON, OHIO

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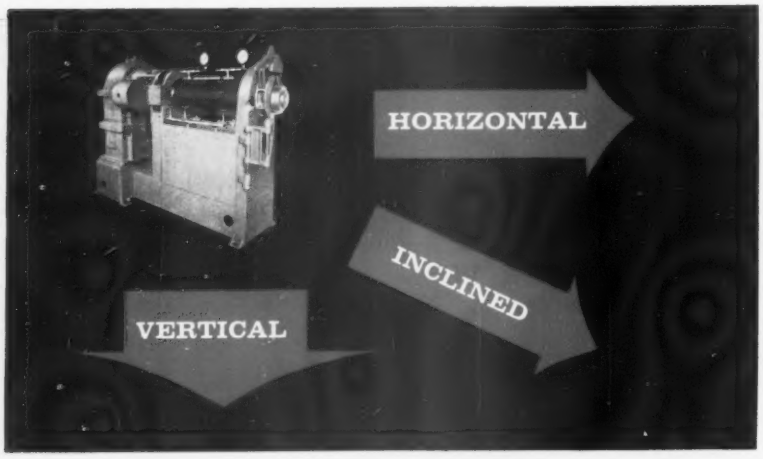

Whatever your CV requirements — you can't afford to overlook these Davis-Standard exclusives:

- Experience — More CV systems engineered and produced than any other manufacturer of extrusion equipment (both new plant layout and integrated systems for existing plants).
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Ask Davis-Standard engineers to lay out and recommend a "MATCHED COMPONENT" system for your CV line.

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News in Brief

► The Synthetic Rubber Division of Shell Chemical Co., Torrance, Calif., has issued a new technical bulletin entitled "Shell S-Polymers in Shoe Soles," which presents several recipes demonstrating a variety of applications in nuclear, casual and specialty soles. The formulations are designed to be used directly or modified to meet special requirements.

► No. 93 of *Elastomers Notebook*, made available by E. I. du Pont de Nemours and Co., Inc., Wilmington, Del., stresses a case history of simulated service testing of belt life, as well as discussing use of Viton parts at flex-induced temperatures of 500 to 600° F., use of Adriprene synthetic rubber for pallet wheels, utilization of Hypalon hose in a sulfuric acid plant, and urethane foam seats for helicopters.

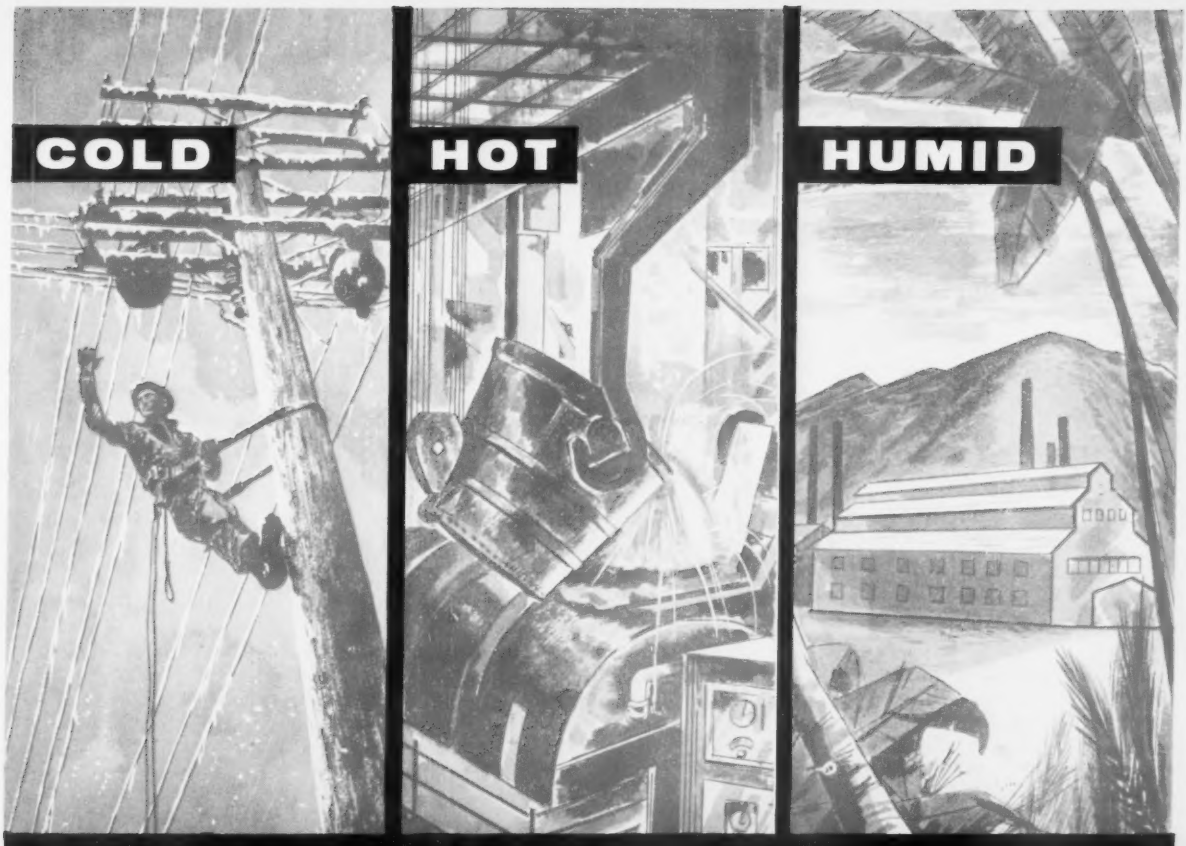
► "Hi-Sil X303," Hi-Sil Bulletin No. 2 (Rev.), which can be obtained from Columbia - Southern Chemical Corp., Pittsburgh, Penna., deals with a hydrated silica of high purity and extremely fine ultimate particle size, according to the company.

► Bulletin No. 10, "Retread Cementing," is the latest in a series of educational bulletins published by the Rubber Manufacturers Association, New York, N. Y. It contains instructions for using both spray type and brush type vulcanizing cement and includes shop hints for most efficiently cementing tire bodies for retreading.

► "Highway to the Moon" is a 25-minute color motion picture showing the current applications and potential uses of Stafoam polyurethanes produced by American Latex Products Corp., Hawthorne, Calif. It is available to companies for the use of design and engineering personnel.

► Wyrough and Loser, Trenton, N. J., rubber chemical suppliers, has moved its main offices to 2 Brunswick Circle Extension in Trenton.

► *Hycar Latex Newsletter*, Issue No. 19, made available by B. F. Goodrich Chemical Co., Cleveland, Ohio, is devoted to Hycar 1572, and includes suggested ways of eliminating adhesion problems encountered in frictioning nitrile stocks to cotton and rayon fabrics.



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In frigid northern climate or in the humid tropics . . . for use with hot industrial machinery or with telephone wires . . . electrical insulation compounds, modified with Marbon 8000 AE resin give superior performance.

This hydrocarbon resin also offers proven production advantages: fast, smooth extrusion at lower mixing temperatures, with less scorch . . . good resistance to heat aging . . . high tear and cut resistance . . . low moisture pick up . . . maximum electrical properties and flexibility of compounding with reduced overall cost.

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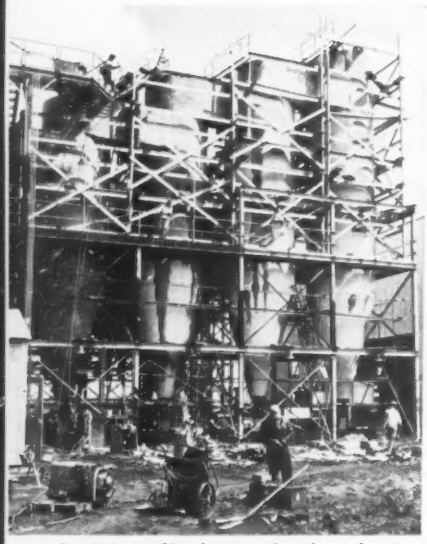
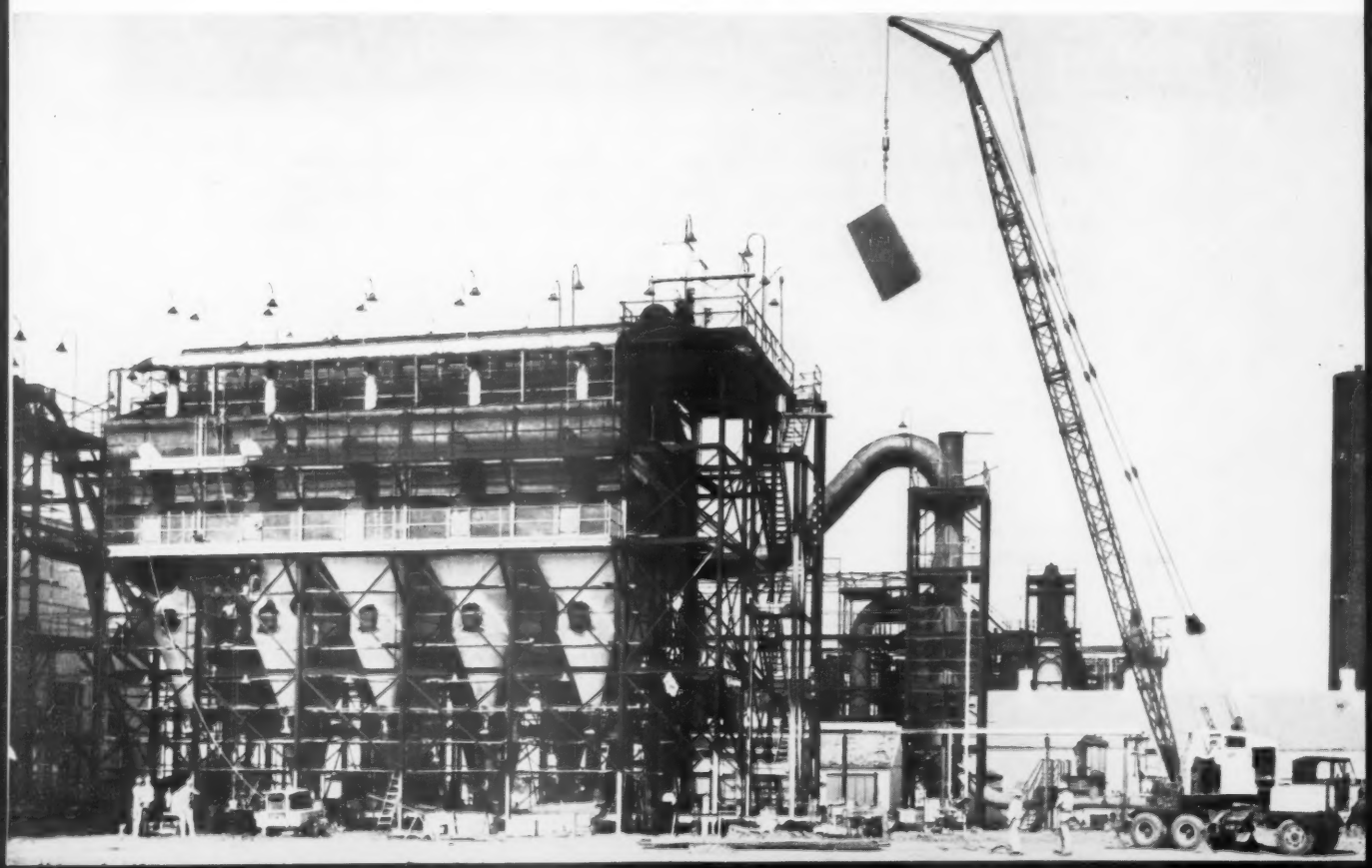


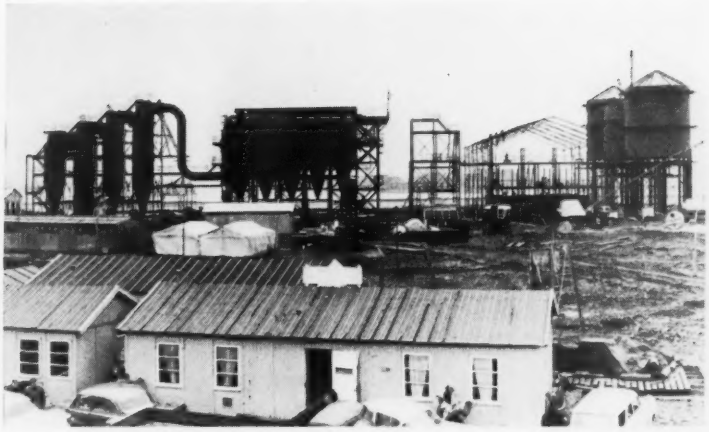
Louisiana: Newly completed production facilities for 25,000,000 lbs per year have just been brought on stream at Westlake to help meet the demand for premium quality carbon blacks.

The demand for quality carbon black by the rubber industry, both here and abroad, has reached a record-breaking level. And within the next few years, this demand is expected to increase even further. To keep pace with these carbon black requirements, Witco-Continental is engaged in a major expansion program to increase the Company's production capacity 50 per cent. New plants are being constructed in California, France and Italy, while a new plant in The Netherlands has now been completed. New additions also have recently been completed for present facilities in Oklahoma and Louisiana. Naturally, new laboratories are also being built to assure Witco-Continental customers the finest technical and other services.

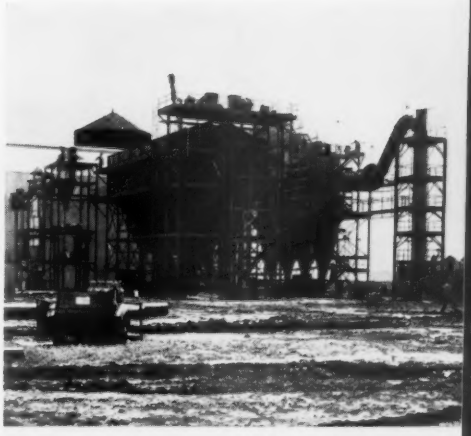
Oklahoma: The new facilities which were added to the Ponca City plant in 1959 increased production at this site by 25,000,000 lbs per year. This new addition has fully instrumented production controls as do all Witco-Continental plants.



CARBON BLACK DOLLAR at Witco-Continental



Europe: Steadily increasing demands for Witco-Continental carbon blacks have led the company to establish plants, laboratories, and sales offices on the Continent. A 30,000,000-lb-per-year plant has been completed at Rotterdam, The Netherlands. A 56,000,000-lb-per-year plant is under construction at Bordeaux, France, and a new 60,000,000-lb-per-year plant is under construction in Trecate, Italy.



California: The first carbon black plant ever to be built on the West Coast will be constructed by Witco-Continental. Located at Bakersfield, California, it will produce 30,000,000 lbs of oil furnace grade blacks per year. This photograph of the new oil furnace addition at Ponca City, Oklahoma is similar to the plant being constructed in California.

WITCO CHEMICAL COMPANY, Inc.
CONTINENTAL CARBON COMPANY

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Sales Offices in: Chicago • Boston • Akron • Atlanta • Houston • Los Angeles • San Francisco • Toronto and Montreal, Canada • London and Manchester, England • Glasgow, Scotland • Rotterdam, The Netherlands • Paris, France.

ROCKS ON THE RUN – In the making by The Port of New York Authority, the second traffic level on one of the world's most beautiful bridges, the graceful George Washington Bridge that joins the Jersey shore to Manhattan Island. The end result . . . beauty pointed skyward, begins with down-to-earth digging, upheaval of earth, removal of rocks, change of terrain. Contractors George M. Brewster & Co., Inc., responsible for a tremendous amount of the work being done on the New Jersey approach to the new level, estimated removal of approximately four hundred thousand yards of rock and one hundred fifty thousand yards of dirt on their contracts alone. New approaches to the bridge had to be cut from huge solid rock cliffs. Much of this rock was processed for re-use on the job as stone backfill, and as concrete aggregate. Thirty-six-inch belts were used to convey the rock from processing plants to hoppers. The belts for this huge operation were made for George M. Brewster & Co., Inc. by Hewitt-Robins, the carcasses of which were made with Mount Vernon fabrics.

This is another example of how fabrics made by Mount Vernon Mills, Inc., and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

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This family's soled on Ameripol Rubber

The Gold Seal Rubber Company makes a variety of canvas rubber soled footwear. Here again Ameripol polymers are preferred because of their superior uniformity . . . well-known stability in processing and excellent physical properties.

A blend of Ameripol 1009 with other polymers results in compounds exhibiting low shrinkage during processing and curing—provides a smooth sheet stock. These compounds have excellent resistance to abrasion and flexing. Thus Ameripol solves the problems of both looking attractive and keeping the user satisfied despite rough wear and abuse.

Goodrich-Gulf produces the broadest range of synthetic rubber polymers in the industry. One of them may be just what you need to put your product a step ahead.

For thorough service contact Goodrich-Gulf Chemicals, Inc., 1717 East Ninth Street, Cleveland 14, Ohio.

Ameripol
THE PREFERRED RUBBER

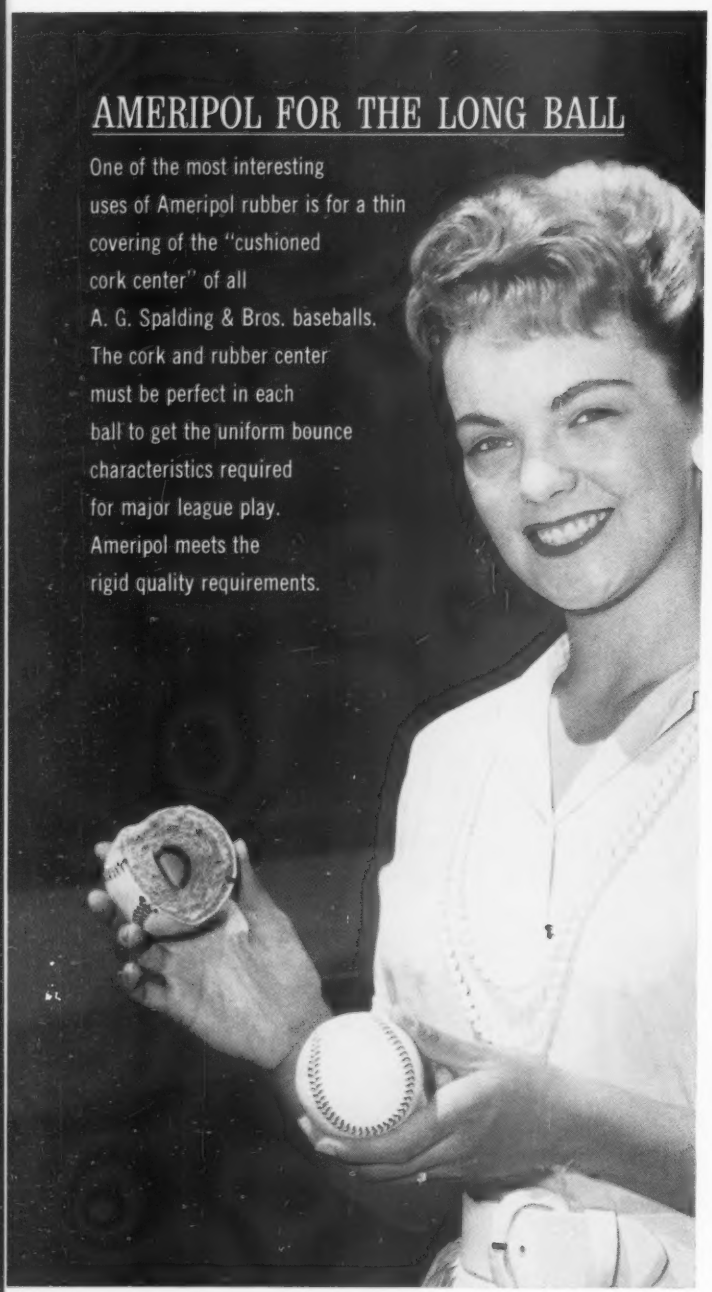
Goodrich-Gulf Chemicals, Inc.

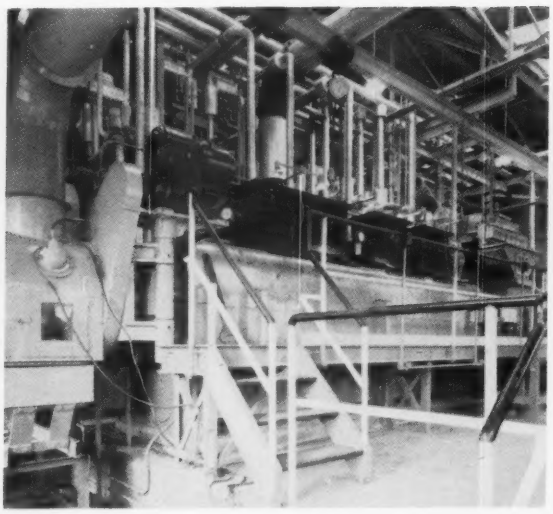
THE ONE TO WATCH FOR NEW DEVELOPMENTS

NEWS FROM GOODRICH-GULF

AMERIPOL FOR THE LONG BALL

One of the most interesting uses of Ameripol rubber is for a thin covering of the "cushioned cork center" of all A. G. Spalding & Bros. baseballs. The cork and rubber center must be perfect in each ball to get the uniform bounce characteristics required for major league play. Ameripol meets the rigid quality requirements.





HUGE MACHINE SETS FAST PACE IN SYNTHETIC RUBBER DRYING

This 40-foot long machine, at the Institute, West Virginia plant of Goodrich-Gulf, is the largest production-scale extrusion dryer in the industry. The machine drastically cuts drying time, also delivers a polymer free of moisture and with low ash content to improve product quality.

The extrusion dryer has a design capacity of 6000 to 8000 pounds per hour. Entire cycle time, from the time wet rubber enters the feed box until it passes through a pelletizing die, is 5 to 10 minutes. Development of this machine represents a major forward step in production of synthetic rubber.

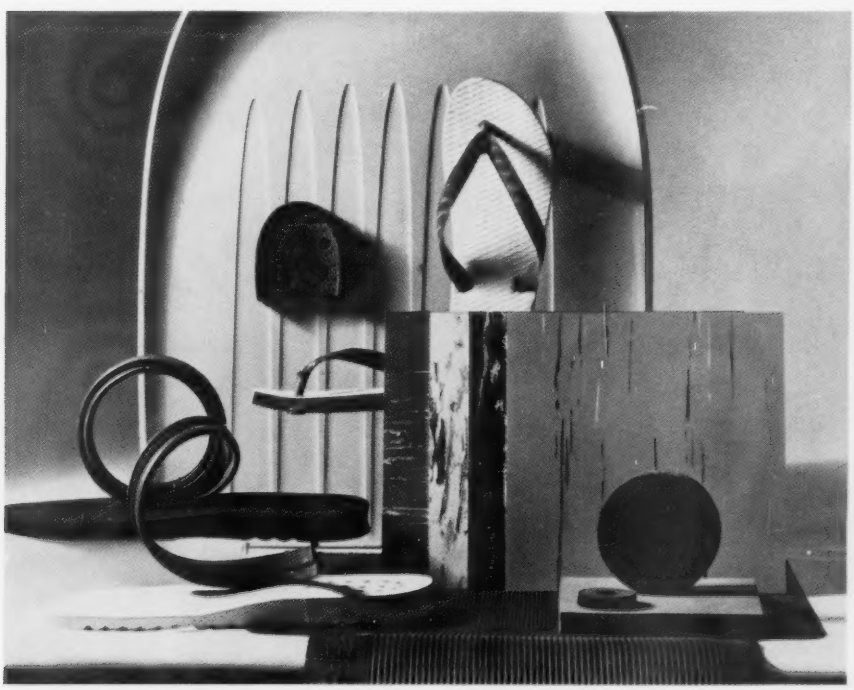
NEW AMERIPOL POLYMER EASIER TO PROCESS ...IMPROVES PRODUCT QUALITY

Ameripol 4601 is a new polymer designed with medium-low viscosity to enable the fabricator to reduce processing time and power costs, and to eliminate the need for costly peptizing agents. Physical properties compare favorably with those of a peptized high-viscosity polymer such as SBR 1502.

This polymer permits easier mixing, smoother calendering, faster extrusion. The polymer exhibits less shrinkage and improved smoothness and quality. The elimination of peptizing agents not only reduces cost, but avoids a possible source of discoloring.

For many types of rubber products including sponge, floor tile, soling and heels, mats, and extrusions, you can switch to Ameripol 4601 and obtain equal or improved physical properties, while reducing processing costs.

This new polymer is another result of Goodrich-Gulf's continuing product development program which can help you in fabrication or use of synthetic rubber polymers. Polymer evaluations and test data are available through Goodrich-Gulf Technical Service. Address: 1717 East Ninth Street, Cleveland 14, Ohio.



AMERIPOL 4601 has ideal qualities for many products

- Light Color
- Low Viscosity
- Good Physical Properties
- Low Water Absorption

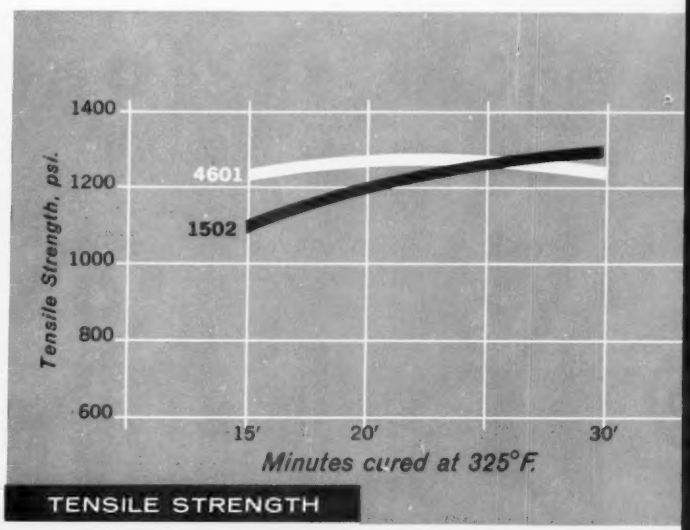
Ameripol
THE PREFERRED RUBBER

Goodrich-Gulf Chemicals, Inc.
THE ONE TO WATCH FOR NEW DEVELOPMENTS

YOU CAN ECONOMIZE IN PROCESSING AMERIPOL 4601— AND OBTAIN EXCELLENT PHYSICAL PROPERTIES

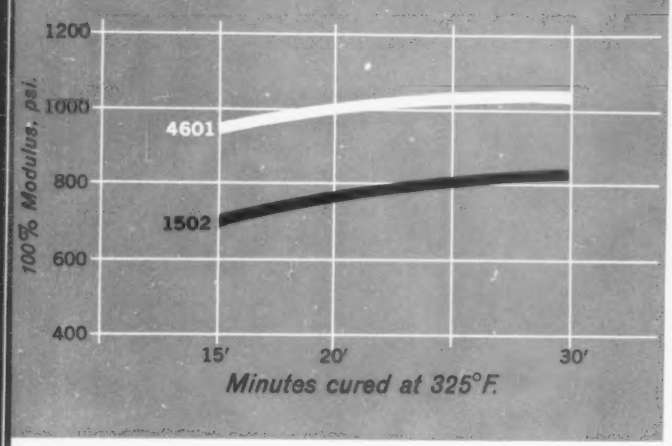
Ameripol 4601 has been evaluated in the Goodrich-Gulf Sales Service Laboratory, with comparative tests to SBR 1502. Stocks compounded in the recipe below tested for various properties, as shown in graphical form.

TYPICAL TILE TEST RECIPE		1502	4601
POLYMER		100.00	100.00
HIGH STYRENE RESIN		15.00	15.00
HARD CLAY		200.00	200.00
WHITING		125.00	125.00
ZINC OXIDE		5.00	5.00
COUMARONE-INDENE 100°C., M.P.		10.00	10.00
LIGHT PROCESS OIL		10.00	10.00
MBTS		1.50	1.50
TMTD		0.66	0.66
CRYSTEX SULFUR		4.00	4.00
TOTAL		471.16	471.16
GENERAL PROPERTIES		**1502**	**4601**
RAW VISCOSITY		53	38
COMPOUNDED VISCOSITY		121	108
MOONEY SCORCH T-3 @ 280°F.		5.9	7.0
SHORE A HARDNESS, CURE @ 310°F.			
	15′	89	89
	20′	89	89
	30′	89	89
ABRASION % STD. B., %		37.5	25.4	23.9
HEAT AGED			
70 HRS. @ 158°F.			
TENSILE, PSI	30′	1510	1350
ELONGATION, %	30′	210	120
100% MODULUS, PSI	30′	1130	1190
SHORE A HARDNESS	30′	92	92

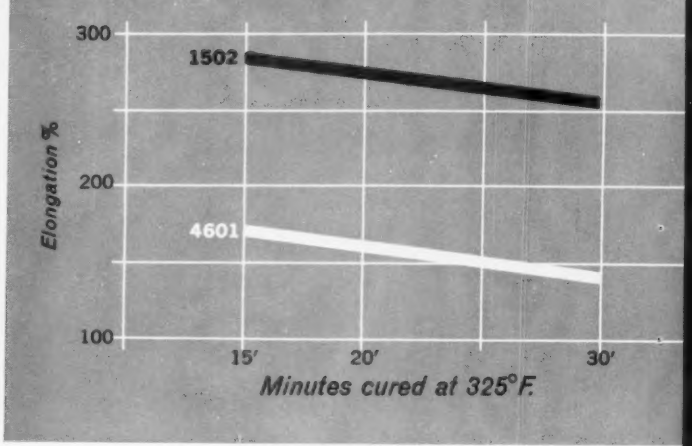


TENSILE STRENGTH

MODULUS



ELONGATION



Goodrich-Gulf Chemicals, Inc.

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Fast Curing Type
ZINC OXIDES

Specially Developed to Meet Your Activation Requirements

GRADE	Black Label 20	Red Label 30	Green Label 42	Green Label 43
Av. Particle Size D_1-Microns	.20	.23	.28	.30
N_2 Specific Surface-Sq. M/gram	10.91	7.04	5.27	5.02
Total S and SO_3	.05	.05	.05	.05
Apparent Density—Lbs./cu. ft.	25	28	30	32
Incorporation	Good	Good	Fast	Easy
Reinforcing Properties	Maximum	Excellent	Excellent	Good
Application	Very fine particle size, giving maximum reinforcement and activation. For highest quality rubber goods.	Excellent reinforcing and activating properties. Having fewer extremely fine particles, it is easier to incorporate than Black Label No. 20	General purpose type. Excellent activating and moderate reinforcing properties. Faster rate of incorporation than Black Label No. 20 or Red Label No. 30	Large particle size type for easy incorporation. Good activating and reinforcing properties.

For activation purposes, 2 to 5 parts of St. Joe zinc oxide normally are used per 100 parts of rubber. The finer particle size St. Joe Zinc Oxides are more effective as activators than the coarser grades, due to their greater active surface and more positive (+) electrical charge which gives faster chemical reaction rates as well as greater solubility in the rubber. For further information, write for St. Joe's Technical Data Book.

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Plant, Laboratory: Josephtown (Monaca), Pa.

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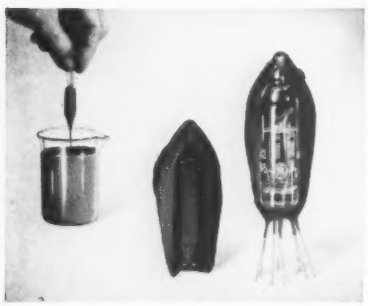
ZNO-161

General Electric Silicone Rubber finds dozens of uses in missile systems. How many more will prove vital?

General Electric silicone rubber has the "thermal toughness" to stand up under the searing heat of rocket blast-off or possible atomic attack. Add very good electrical properties and excellent resistance to aging, weathering, moisture, flame, ozone and corona and you can easily see why silicone rubber is now being used in virtually every U.S. missile and space vehicle.

Since both space technology and silicone rubber are relatively new, General Electric believes there are many more areas not yet explored where silicone rubbers can help keep a missile functionally reliable and combat-ready. To help designers in their evaluation work, we list here the principal properties and applications of G-E silicone rubber.



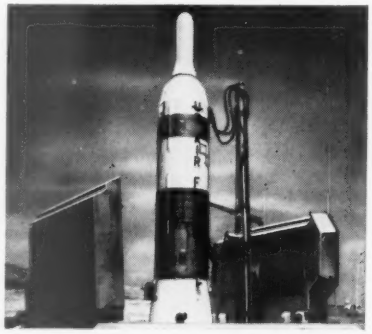
RTV LIQUID SILICONE RUBBER — One of the most versatile materials developed in recent years, RTV is a liquid rubber that cures at room temperatures. Like all silicone rubber, it remains flexible over a wide temperature range and is virtually ageless. Since it comes in a wide range of viscosities, it can be poured, sprayed, dipped, painted or applied with a pressure gun or spatula. It bonds tightly to metal when a primer is used. When not primed, you can readily remove RTV and then reapply more. You can impregnate tightly wound coils with RTV or form sections several inches thick.

You can control cure time from two minutes to 24 hours. These are RTV's typical properties:

Viscosity	from 120 poises (very pourable) to 12,000 poises (paste)
Specific Gravity	1.2 to 1.5
Solids Content	100%
Shrinkage	0.2%
Heat Resistance	from —90°F to 600°F, and as thermal insulation, in 5500°F flame for minutes
Ozone Resistance	Comparable to Mica
Electrical Properties	See last table

Applications—RTV is used as a high temperature structural sealant in missiles, satellites and space vehicles. It is used to pot and encapsulate electronic components and assemblies for electrical and heat insulation and for protecting delicate components from physical damage. It is commonly used as an impregnating insulation in transformer coils, to pot and hold cable in raceways and to pot cable breakouts. You can make flexible molds with RTV and hence make accurate, duplicate castings from originals.

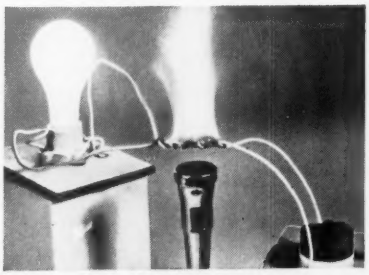
RTV is an excellent thermal barrier and as such is applied on and around missile nozzles. Tests show RTV's resistance to flame temperatures as high as 5500°F for several minutes. RTV also functions as a flexible ablative material and is used around probe holes, along raceways, and between stages and structural joints on the missile skin.



HEAT CURED SILICONE RUBBER PARTS —Silicone rubber gaskets, port seals, O-rings, shock mounts and other mechanical parts are not only used on missiles but have wide application in ground support equipment. For instance, missile silo doors use silicone rubber seals that will stand up to outside weathering, ozone and abuse for years and which will also resist the heat of missile launching and nuclear attack. Silicone rubber also resists brief exposure to cryogenic materials.

Silicone rubber has long-lasting temperature resistance from —150°F to 600°F, with excellent electrical, weathering, ozone, corona, radiation and nonaging properties at these temperatures. High tensile strength and low compression set are also within its range of desirable properties:

Tensile Strength, psi	800—1500
Elongation, %	100—600
Hardness Durometer (Shore A)	25—80
Compression Set, %	10—80
Tear Resistance lb/in	40—200
Radiation Resistance	1×10^8 roentgens
Electrical Properties	See table below



WIRE AND CABLE INSULATION — The long term reliability of silicone rubber when operating in high ambient temperatures and when current over-loads cause the conductor to approach 500°F is an important feature of silicone insulation. In an 1800°F flame, specially constructed silicone rubber insulated cables will continue to insulate for hours, forming a non-conductive ash that gives off no toxic fumes. And short term reliability is obtained even when silicone rubber is exposed momentarily to a direct flame of 5500°F.

Because of this excellent heat resistance, more current can be carried than in conventional cable (or smaller cable can be used). Other features: best compression set of all elastomers at temperature extremes, so that silicone rubber wire and cable does not deform under clamps; high ozone, corona, radiation and weather resistance, low moisture absorption, flexibility down to —100°C. These are the typical properties:

Volume Resistivity	10^{15}—10^{16}
Dielectric Strength, volts/mil	600—650
Dielectric Constant, 60 cps	3.0
Power Factor	.0010—.0050
Radiation Resistance	1×10^8 roentgens
Physical properties	Similar to table above.

Applications—Wiring harness made of silicone rubber insulation is often found throughout missiles. Cable offers added reliability for use in various places throughout the launch complex below ground from power plant to silos. All combat vessels built for the U.S. Navy during the last ten years, including fleet ballistic missile submarines and the new nuclear-powered cruiser and aircraft carrier, have silicone rubber insulated cable installations in all fixed wireways. In every case, silicone rubber is chosen because it is virtually non-aging, stands up to intense heat better than any other flexible insulating material, and continues to operate even when subjected to fire.

●

There are many more places where G-E silicone rubbers' inherent properties can be vital in missiles, satellites and space vehicles. For further data, call your nearest G-E sales office or write Section HH1133.

Silicone Products Department, General Electric Company, Waterford, New York.

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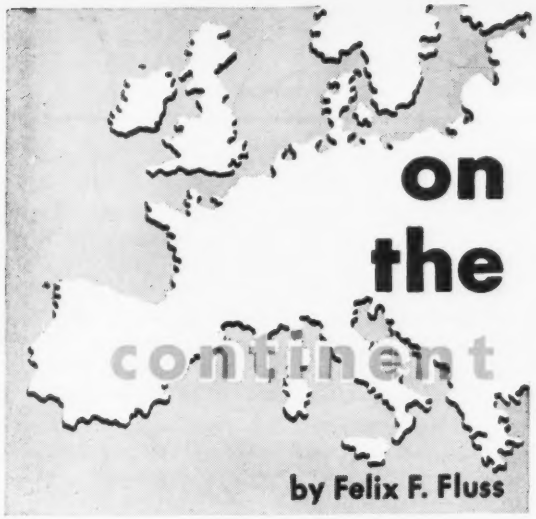

• **Germany's Rubber Industry Doing Well.** The member companies of the German association of the rubber industry (Wirtschaftsverband der West-Deutschen Kautschuk-Industrie) currently employ about 101,000 people, an increase of about 8 per cent over the same time last year. During the first six months of 1960 about 264,000 tons of rubber goods have been produced, of which 126,000 tons were rubber tires. The output has increased by 19 per cent compared with the same period of last year. From January to the end of June, about 46,000 tons of synthetic rubber have been used, compared with approximately 30,000 tons in the first six months of 1959, which means that the consumption of synthetic rubber has increased by 25 per cent.

• **World Production of Synthetic Rubber.** During the German Rubber Congress which was held at the beginning of October in Berlin, it was estimated that the total rubber production of the world will reach 4.83 million tons this year. Of this, 2.17 million tons will be natural rubber, and the balance of 2.66 million tons, will be synthetic rubber. In 1965 the total production of the world will reach approximately 6 million tons, of which only 2 to 2.5 million tons will be natural rubber. World production of natural rubber has increased during the last ten years, by 9 per cent; yet, world consumption of rubber products has grown by 65 per cent. It will take another three to four years before the present facilities for manufacturing synthetic rubber and the plantations producing natural rubber, will be able to cover the requirements of the world. In 1965 Germany will require approximately 142,000 tons of natural rubber, whereas the consumption of synthetic rubber will reach approximately 163,000 tons, about 53.4 per cent of the total consumption.

• **Farbenfabriken Bayer AG. Leverkusen.** This section of the former I. G. Farben concern is extending its capacity for manufacturing synthetic rubber type Perbunan C to 25,000 tons a year to meet the requirements of the rubber industry. The factory has started producing a new synthetic rubber called Urepan E. This new product will be available for special purposes at the end of this year. Next year the company will produce, based upon a new development, new synthetic rubbers—polymers based upon ethylene-vinyl-acetate. Bayer is planning to enlarge its production facilities for polybutadiene and polyisoprene based upon the application of new catalysts.

• **Technically Classified (TC) Natural Rubber.** There are now 63 estates in Malaya producing Technically Classified natural rubber, their monthly production totaling approximately 2,300 tons. Technically Classified rubber was introduced to enable rubber manufacturers to dispense with much preliminary blending and control testing. It is believed that more use could be made of TC natural rubber, particularly by the smaller manufacturers who do not have the same facilities for blending that the larger manufacturers do.

Technically Classified natural rubber is rubber of any existing International Grade on which additional information about its technical properties has been obtained. There are three classes of TC natural rubber, termed Blue Circle, Yellow Circle and Red Circle, the classification being based solely on the rate of vulcanization, as measured by a strain test. Blue Circle has a fast rate of vulcanization. Yellow Circle a medium rate and Red Circle a slow rate.

• **Firestone Investment In Liberia.** Firestone is spending about $1 million to increase the capacity of its factories in Harabel and Cavalla. As the rubber production of the planters has doubled during the last year, the capacity of the two factories will be increased by 18 million tons a year. Liberia has exported approximately 45 million pounds of latex and 40 million pounds of natural rubber during the last year.

• **Bunawerke Production Rise.** As a consequence of utilization of its fourth processing and flow line, the annual production of Bunawerke Huels GmbH in Marl, Germany, will reach 120,000 tons. The six different types of styrene rubber hitherto manufactured will be augmented by additional kinds of cold synthetic rubber. Production of black carbon rubber will start during the last quarter of 1960. At this time, Bunawerke will come the largest European producer of the most commonly used types of cold synthetic rubber.

• **New Standards for German Trucks.** Production of heavy truck tires has suffered because the German authorities procrastinated in establishing standards for heavy trucks. The issue has been further complicated by the fact that different standards prevail within the European market. Finally the German

Government agreed to promulgate new standards equivalent to the standards of France and other members of the European Common Market. Recently the Federal Government sent new regulations covering the sizes and loads of trucks to the German Parliament. The maximum length will be 54 feet and 5 inches, and the maximum load is 35.2 tons, and the driving axle can be subjected to a load of 11 tons. Previous regulations indicating lesser length and weights have been cancelled.

• **Will the European Boom Last?** In view of the shortage of labor which is growing worse, it is quite possible that Europe will continue enjoying its favorable manufacturing climate. In order to overcome the dearth of labor, various European countries are employing foreign nationals. Twenty-five per cent of the workers employed in Switzerland are not Swiss, in West Germany the amount of foreign labor has doubled within the last twelve months and has reached a total of 326,000 persons. Italy is unable to furnish more workmen to other European countries. For this reason there will be wage and salary increases in Germany and other European countries of about ten to fifteen per cent in the near future. The retail prices in West Germany will rise by about six to ten per cent, considerably more than the wage increases. As a consequence the boom will be prolonged and Europe will enjoy excellent employment records for a number of months to come.

• **Standardizing Natural Rubber.** Coagulation in partitioned tanks, which are still widely in use on estates, entails variations in the technical properties of rubber. The present trade classification, based exclusively upon aspect, does not reflect such variations. A first effort has therefore been made to put on the market rubbers classified exclusively by vulcanizing characteristics. (Technically Classified rubbers or TC).

The authors of this very enlightening review published in our French counterpart, *Revue Generale du Caoutchouc*, in June 1960, have tried to adapt coagulation conditions to various types of latices, to produce rubber with constant curing characteristics, and have noted that this technical improvement is sometimes made possible only by sacrificing the visual aspect. This shows how irrational the present trade classification may prove.

To ensure a consistent production, it was necessary to change the coagulation method outright, in order to ensure the preparation of a product to be judged solely on the basis of technological criteria. Two types were thus developed at the pilot stage. They are: Standard C 57—with the properties of smoked or dried sheet, which agrees with the Blue Circle technical classification and may be obtained through continuous processing, involving automatically controlled acidification, heat coagulation and coagulum granulation; and Standard F 58—which looks rather like very pale crepe, and is produced by a flocculation process, also continuously.

With both processes, it is possible to ensure not only constant but also markedly better properties, thanks to a controlled coagulation pH and a more rational accommodation of drying conditions.

• **SR and Polyvinyl Chloride Installations in Roumania.** The chemical factories in Borzesti have been enlarged by a synthetic rubber installation with a capacity of 45,000 tons a year. Also, a new factory for the manufacture of polyvinyl chloride, with a capacity of 33,000 tons a year, has been put on stream. In Turda (formerly the southern part of Hungary) another factory for the production of PVC, which will have a yearly output of 55,000 tons, has been constructed. In Fogaras, northeast of Bucharest, a factory for the production of phenolic resins, with a capacity of 3,000 tons a year, has been finished.

• **Synthetic Rubber Plant in India.** *The Indian Rubber Bulletin* of August 1960 contains a number of interesting details concerning a new synthetic rubber plant. Synthetics and Chemicals Ltd. is the title of the new company set up by Firestone Tire & Rubber Co., Akron, Ohio, in collaboration with Kilachand Devchand & Co., Private Ltd. In 1962 the new facilities will produce 20,000 tons of synthetic rubber a year and latices of the butadiene-styrene type. A styrene plant with a capacity of 9,000 long tons per year and a butadiene plant with a capacity of 15,000 long tons will also be set up in order to supply raw materials for the synthetic rubber plant.

Firestone Tire & Rubber Co. has agreed to provide $5,625,000 in cash to purchase machinery, equipment and initial stores. Four American banks have agreed to advance $6 million; the Export Import Bank of Washington will extend a long-term loan; and part of the capital will be subscribed by the Indian partners of the new company.

Firestone will receive $750,000 to reimburse the company for the expenses of designing, engineering, construction and start-up services. Further, a disclosure fee of $300,000 will be given by Firestone to its associates in the field of styrene and butadiene production.

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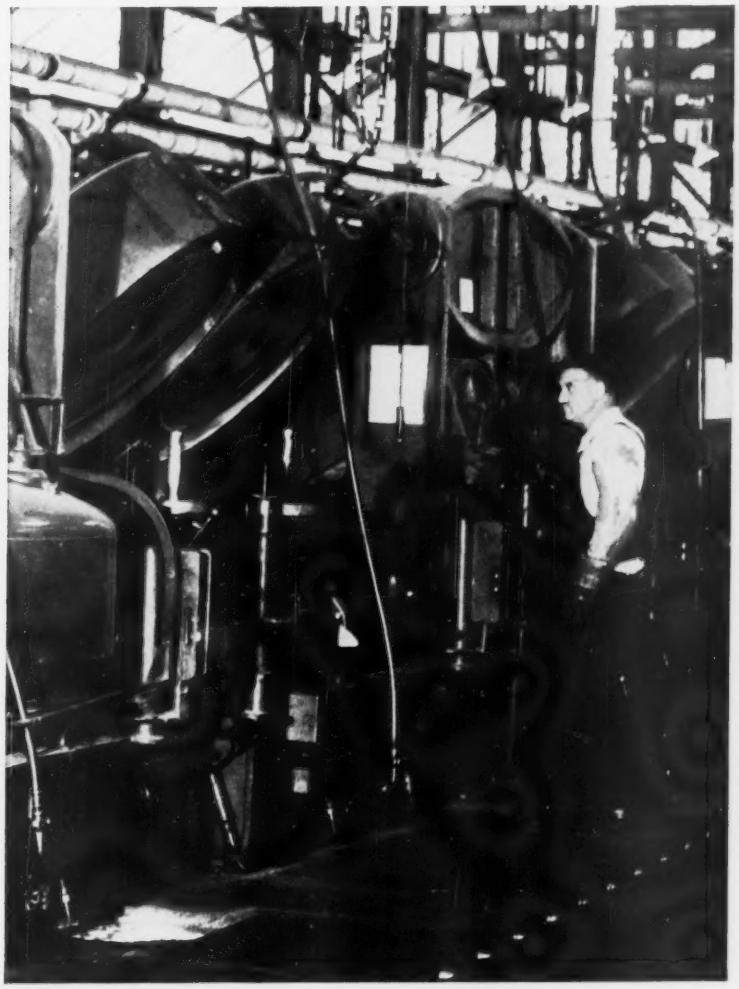
SILICONE NEWS from Dow Corning

Keep Production Moving



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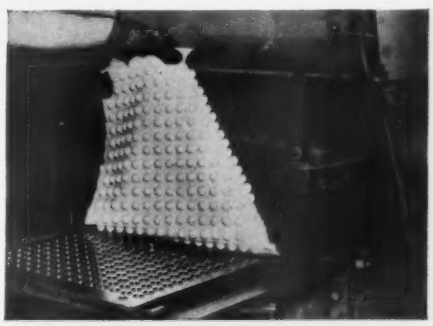

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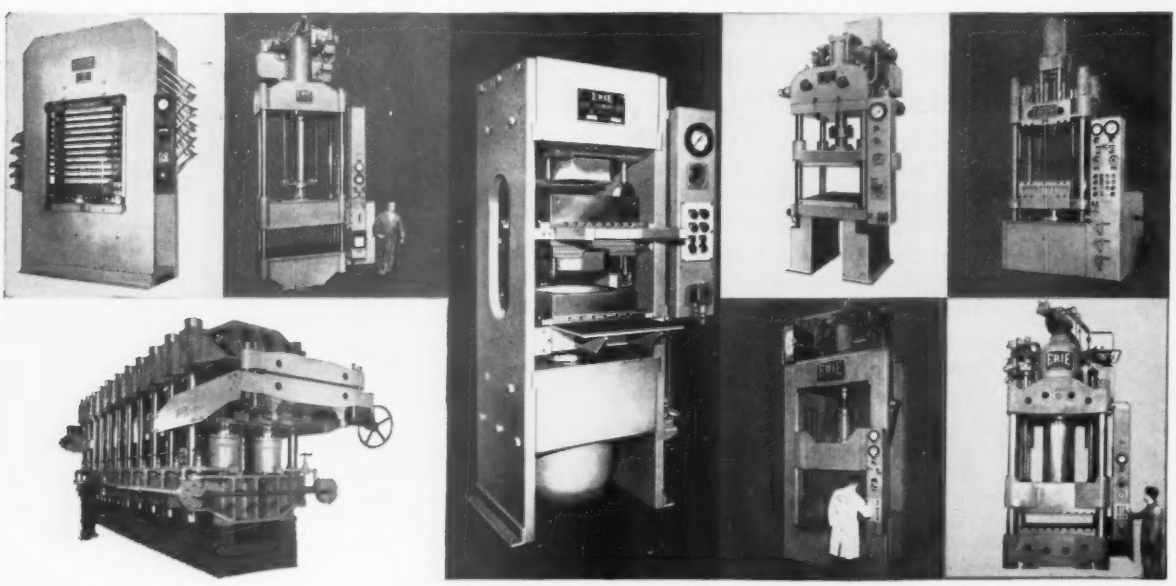

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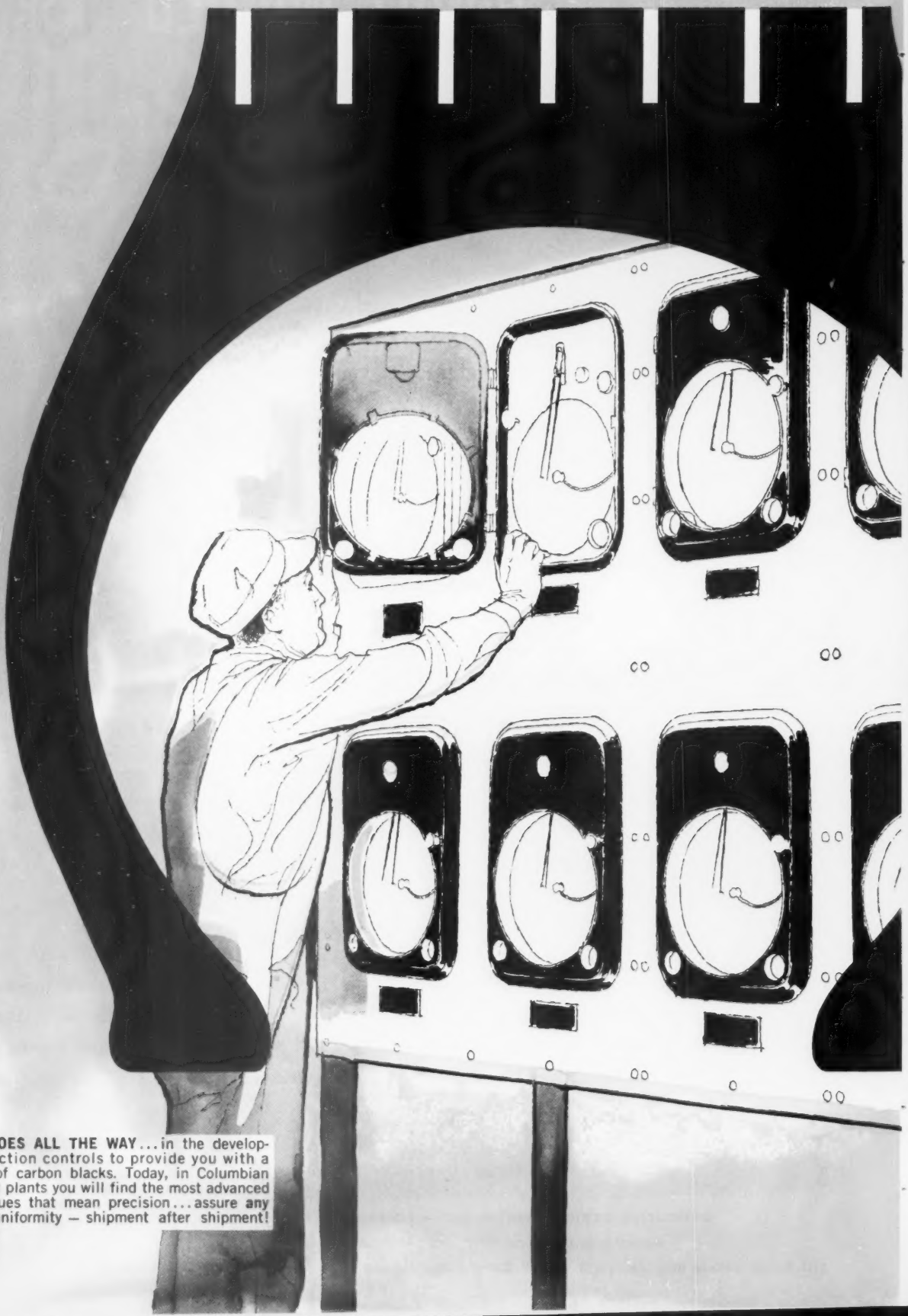

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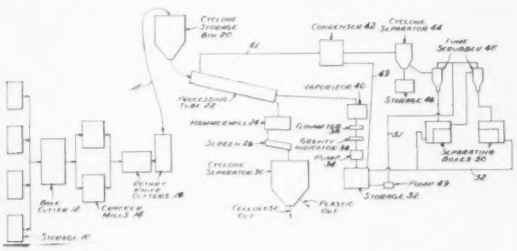
PATENT REVIEW

by Melvin Nord

Reclaiming Fiber-Rubber Scrap

U. S. Patent 2,927,342, issued March 8, 1960 to Paul J. Dasher and assigned to Dasher Rubber & Chemical Co., provides apparatus for reclaiming fiber-rubber scrap. In the illustration, numeral (10) indicates storage bins for receiving rubber scrap to be reclaimed. From storage bins the rubber travels to a bale-cutter (12) which cuts the scrap into blocks for convenient handling. The scrap blocks travel to one or more cracker mills (14), which break up the blocks into rough, coarse sheets. In turn these are carried to rotary knife



cutters (16), employed in pairs. Two cutters are positioned at right angles to each other, so that a rough scrap sheet fed into the first is cut into many narrow strips. The strips pass to the second cutter at ninety degrees and are cut into small pieces. In fact, all particles of the scrap broken up by this process will now pass through approximately a 3/8" screen.

Breaking up or comminuting scrap to relatively small particle size, insures that vegetable fibers, or fabric, embedded in the scrap are exposed at least at their ends on one or more surfaces. Since no piece of scrap or vegetable fiber is very long, vegetable fibers are adequately exposed to attack by acid vapors.

From the rotary knife cutters (16), the broken scrap is passed by an air conveyor (18) to a storage bin (20). Preferably this storage bin should be a cyclone or blower type, so that if any light pieces of the fabric are mechanically removed from the rubber, these pieces are separated and removed from the rubber scrap by the cyclone storage bin. Rubber scrap is fed from the storage bin (20) by gravity, and with the aid of centrifugal feeding, to an acid vapor processing tube (22). The rubber scrap moves through the processing tube (22) to a hammer mill (24), which serves to break up and mechanically separate rubber scrap from fabric which has been attacked by acid vapors in the processing tube. From the hammer mill (24), the rubber scrap passes to a

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NEW DEVELOPMENTS

Among the experimental adhesives now available for evaluation are:

• Adhesive EX-B150-1 permits heat bonding of dissimilar unvulcanized elastomers. It is the first to provide successful rubber-to-rubber bonds between elastomer combinations previously thought impossible to join, particularly where one is based on butyl. Typical applications include conveyor belt covers to bodies, wire and cable jackets to insulation, hose covers, roll covers and multilayer gloves.

• Adhesive EX-B579-1 bonds RTV (room temperature vulcanizing) silicone rubbers to metals, glass, ceramics, plastics and fabrics. One-part, one-coat, nonstaining adhesive provides bonding during the room temperature cure. It meets electronics industry standards, offers excellent environmental resistance to broad temperature conditions.

TECHNICAL LITERATURE

A letterhead request will bring you any of the following:

Technical Bulletin 2012 **"Chemlok Rubber-to-metal Adhesives"** presents comprehensive information on Chemlok 220 and 203.

Technical Bulletin 7101 **"Preparation of Substrates for Bonding"** is a valuable guide to proper surface preparation procedures.

"Some Fundamental Aspects of the Problem of Rubber-to-metal Adhesion" is the title of a technical article reprint which examines theoretical considerations in bonding.

Product bulletins and samples are available on all Chemlok Adhesives—standard, special, experimental. Please define your application area.

SPECIAL-PURPOSE PRODUCTS

Specialty Elastomer Adhesives: Silicone rubber, Viton A, Hypalon and other specialty elastomers are successfully bonded to metals, fabrics and other materials with Chemlok 607.

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PATENT REVIEW

screen (26), which is vibrated to separate out and discard objectionably large particles of scrap. The material then passes to the cyclone-separator (30), which centrifugally and with the aid of air separates the refined scrap from the hydrolized fiber. The fiber, as well as the scrap, is salvaged and can be used as a filler for rubber or plastic or as cellulose having a long chain length.

Acid vapor is passed through tube (22) in direction opposite to flow of scrap. The acid vapor, obtained from hydrochloric acid in storage tank (32), is lifted by pump (34), passed through gravity indicator (36) and flow meter (38), to vaporizer or boiler (40), and conducted by acid-resisting pipe to processing tube (22).

From processing tube (22) acid vapor is withdrawn, usually by suction, by acid-resistant conduit (41) to condenser (42). A large proportion of the acid and water vapor is condensed in (42) to liquid acid, which flows back to storage tank (32) by way of conduit (43). Uncondensed vapor passes to cyclone separator (44) which removes any fabric pulled into the separator. This fabric passes to storage tank (46). Jet fume scrubbers (48) draw remaining acid vapor from separator (44) into separating boxes (50), simultaneously condensing the vapor. The condensed liquid flows by conduit (52) back to acid storage tank (32). Fume scrubbers (48) and separating boxes (50) are connected in series to insure that acid vapor fumes will not escape to the atmosphere.

Preparing Butyl Rubber in Solution

U. S. Patent 2,927,912, issued March 8, 1960 to Augustus B. Small and assigned to Esso Research & Engineering Co., provides a new method for carrying out a low temperature Friedel-Crafts copolymerization of isolefins and diolefins to make synthetic rubber. It also provides an improved method of effecting this polymerization in the presence of a liquid which is a solvent and diluent for the reacting monomers as well as a solvent for the resulting polymer.

According to the present invention, the over-all polymer quality is improved. At the same time there is considerable saving in the cost of producing the polymer. The reactor effluent shown in the illustration is composed of dissolved polymer, insoluble or gel polymer and unreacted feed. Effluent is passed into a settling zone such as tank or other suitable equipment. Difference in density of gel polymer and solution is sufficient to cause gel polymer to settle to bottom. Then the resulting upper solution, substantially clear, is fed back to the reactor, with only enough fresh feed to make up for gel polymer removed.

Gel polymer is withdrawn from bottom of the

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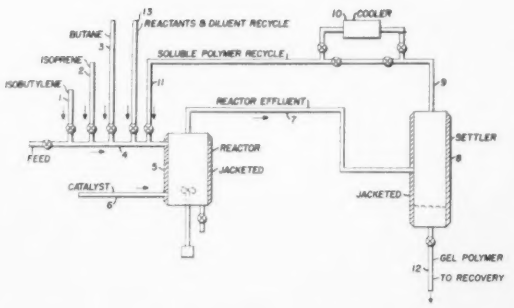
PATENT REVIEW



settler and may be recovered by any suitable means. One way is a wet finishing process: gel polymer slurry is injected into a hot water flash tank to flash off volatile solvent and leave a slurry of insoluble copolymer particles in water. A "dry" recovery process (not using water) is another means: volatile solvent and unreacted monomers are flashed off from a hot drum drier or other suitable equipment.

By this technique the polymer with high molecular weight and high Mooney is readily separated and recovered, without being contaminated by the less desirable low molecular weight, dissolved polymer. The latter has an indefinite residence time in the reactor, because of recycling, and is given further opportunity to enter into polymerization reaction.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Tire shaping and vulcanizing press	The McNeil Machine & Engineering Co.	2,927,343	3/8/60
Production or rubber rings	George Angus & Co. Ltd.	2,927,344	3/8/60
Manufacture of reinforced corrugated hose	The Dayton Rubber Co.	2,927,625	3/8/60
Production of expanded polyurethane polymer	United States Rubber Co.	2,927,905	3/8/60
Siloxane elastomers	Dow-Corning Corp.	2,927,907	3/8/60
Tire handling apparatus for retreading molds	The James C. Heintz Co.	2,928,119	3/15/60
Continuous coating of a cord with rubber	Dunlop Tire & Rubber Corp.	2,928,122	3/15/60
Embossing apparatus	United States Rubber Co.	2,928,124	3/15/60
Endless slide fastener closure	The B. F. Goodrich Co.	2,928,155	3/15/60

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.

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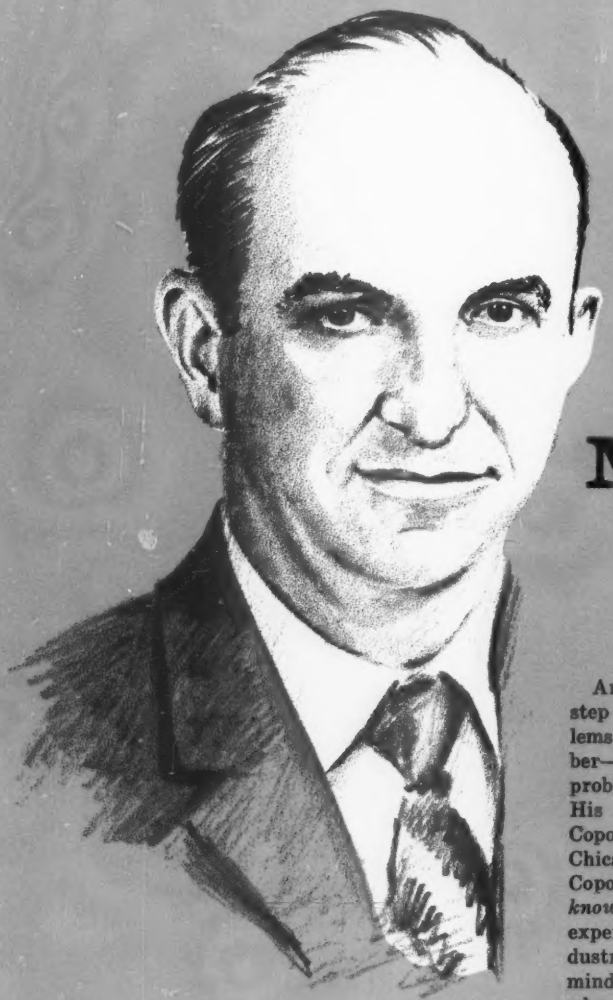

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Overseas

London—Esso Petroleum Co. is planning a $12,040,000 plant with a capacity of 30,000 tons a year, for the production of butyl rubber. The plant will be located near the company's refinery in Fawley, Southampton. Completion will take two to three years, and the plant is expected not only to fulfill all British requirements for butyl, but also to provide butyl for export.

Tokyo—The Yokkaichi plant of the Japan Synthetic Rubber Co. will go on stream shortly, with an expected annual capacity of 45,000 tons.

Buenos Aires—The Goodyear Tire and Rubber Co. has announced that it will spend $2.8 million in expansion of its Argentine plant at Buenos Aires. The plant produces tires, tubes, industrial products and shoe products.

Mexico City—Two companies are planning to start nylon cord production in Mexico. (At present the Mexican tire industry uses rayon cord almost exclusively). Celanese Mexicana, S.A., plans to start production during the first quarter of 1961 with a capacity of 4 million pounds per year, and Cellulose y Derivados, S.A., a Mexican concern, will follow suit by the end of the year. The new Celanese Mexicana plant will be located at Toluca. Firestone will provide help on process and equipment design, and technical assistance after the plant is in operation.

The Hague—N.V. Transicol has begun construction of a plant to make catalysts for synthetic rubber at Geertruidenberg, the Netherlands. The output of synthetic rubber for the area last year exceeded 340 million pounds and is expected to reach nearly a billion pounds by 1962.

Buenos Aires—Texas Butadiene and Chemical Corp., New York, N. Y., is expected to win the contract for Argentina's first synthetic rubber complex by the end of the year. Plans now being negotiated call for construction of a $54 million, three-plant complex by Texas Butadiene. Production is slated to include 44,000 tons a year of butadiene, 60,000 tons of synthetic rubber, and 25,000 tons of carbon black. Styrene would come from a plant proposed by Koppers.

Bogota—B. F. Goodrich Chemical Co., Cleveland, Ohio, will construct a factory for the manufacture of geon vinyl plastic materials near Bogota, Colombia, in cooperation with Colombian participants, and is forming a new company for this purpose. Construction will begin shortly, and production is slated for early 1962. The plant will be the first to produce polyvinyl chloride in Colombia.

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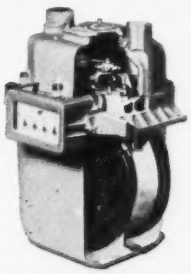

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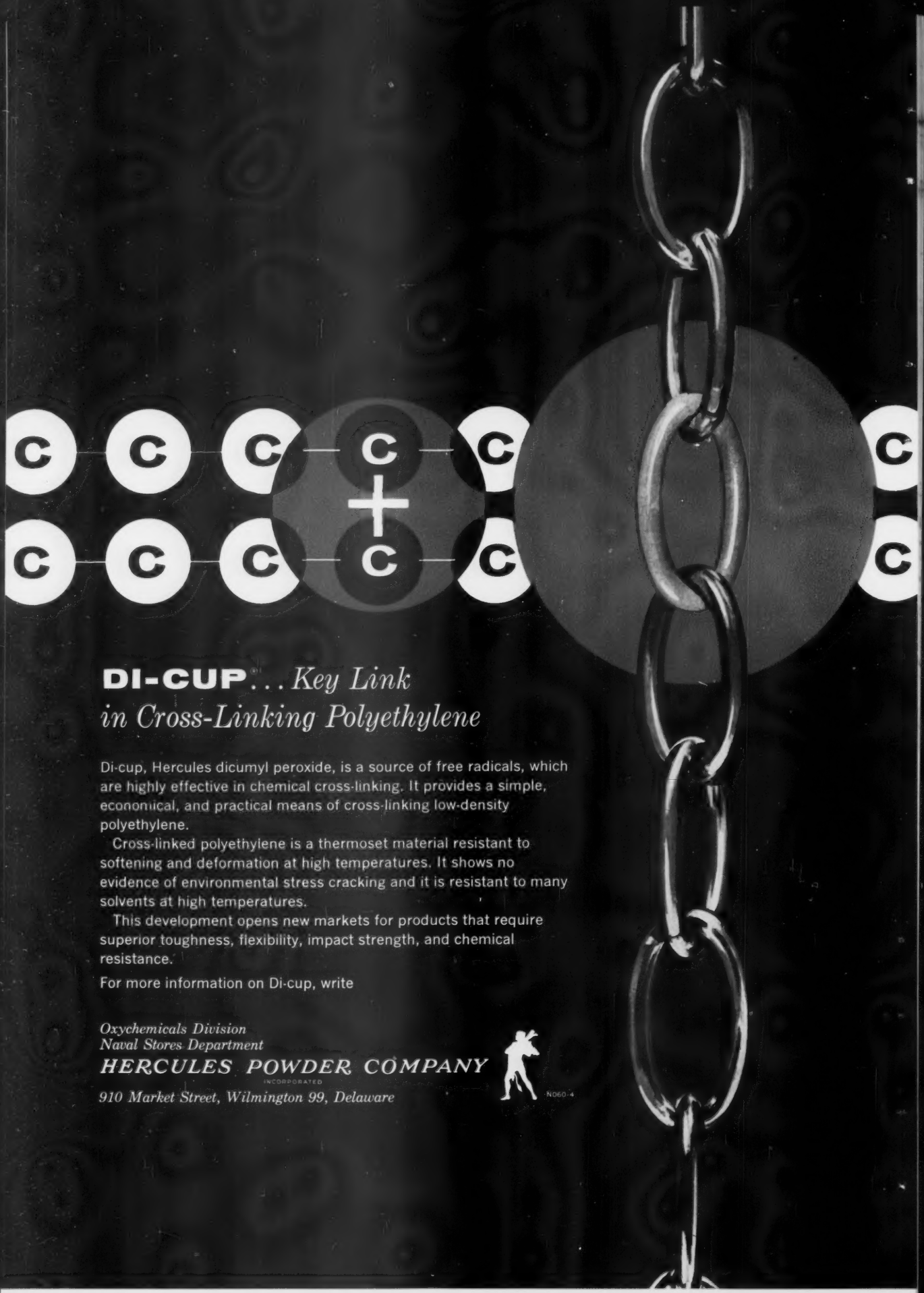

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As Ken Soule Sees It

by Kenneth J. Soule

Emergency Storage Tanks

The problem of providing for the purchase, storage and distribution of defense petroleum products in this country and overseas falls to the lot of the U.S. Navy. This is obviously a colossal task, and one which is far from static as to the types and amounts of material required. As Allen M. Smythe, writing in *The New York Herald Tribune*, points out, yearly expenditures for jet fuels in the last twelve years have gone from zero dollars to around $500 million currently! During the same period the outlay for aviation gasoline has fallen off sharply. Now it is about $264 million yearly, and still dropping rapidly.

Obviously, one very important facet of this entire fuel procurement matter is that of storage. The Navy's "dispersal and protective petroleum program" provides initially for seven storage areas of from 100,000 to 1,000,000 barrels capacity. These are located near strategic air or naval bases. Three others are said to be in the blue-print stage, with others to follow as needed.

The storage tanks in general are constructed of concrete and are more or less completely underground for purposes of concealment. This is accomplished either by partially burying the tanks and using the excavation dirt to cover them, or by digging a hole large enough to contain the tank. Another alternative is to place the concrete containers in natural or hollowed out caves in hilly country, in order to permit the fuel to flow by gravity if desired. In any case, this type of storage is said to be economical to build, as well as low-cost to operate and maintain. It is also claimed that such installations could easily prove valuable for civilian use, if and when the Navy no longer needs them.

Another type of container of particular interest to the rubber industry is the mobile fuel storage tank. In use this would be submerged under water. The Navy is encouraging successful development of such an item because of the versatility which it would offer, both as to products handled and the ready possibility of being moved from one location to another, if necessary. Such tanks, in general, would be built of nylon fabric. They would be "rubber" covered on the outside and lined with suitable synthetic coatings to handle the liquids involved. The construction would probably be similar to that of portable rubber tanks. These are now becoming quite common for truck transport of various liquids, or of "flexible oil barges," such as the "Dracone."

In use, the tanks would be anchored under water by means of special cradles. For the present, these containers would probably be limited in size to an individual capacity of 25,000 barrels. However, as more experience is obtained and the construction and handling details are thoroughly worked out, there seems to be no reason why flexible tanks of much larger size would not be entirely practical. Such "tank farms" would be of great benefit, both to the defense effort and to the rubber industry.

Trees — Then and Now

Contrary to the views held by certain small segments of our population, Joyce Kilmer did not invent trees. He was not even the first person to write lyrically about them. It is true that, in the dim dark past when poetry looked and sounded like poetry, (even to the extent of having words rhyme,) he wrote beautifully, simply, and convincingly regarding trees. However, other contemporary poets as well as many writers of earlier generations, have also left us charming word pictures of trees in general, and of certain types, in particular. For example, take the White Birch—variously described as —"Most beautiful of forest trees," "The Lady of the woods," or, "Like a fair lady in a far country," or, "The silvery stems of delicate birch trees."

It is certainly not my intention to get into an argument concerning the question of whether or not trees have been somewhat over-rated with regard to their virtues and over-all merits. There surely can be no doubt that the shade which they provide can make all the difference between a lovely home and a barely endurable habitation. Also, that there is no other sight on this earth which quite equals the splendor and radiance of a shapely tree covered with young leaves, shimmering in an early Spring morning.

However, I have the feeling that the march of civilization and the rapid expansion of the suburbs must have brought changes not only to the life and habits of people, but to those of plant life as well. While it is true that in the "good old days," spraying was carried out to destroy certain insects and fungi, the practice was limited almost entirely to orchard trees. As far as shade trees were concerned, my recollection is that they were pest free as well as lovely to look at. This must have been a major part of the reason why the poets and authors were so lyrical in praise of these leafy beauties —for instance, the Birches.

If we now move up to the present time, I find it impossible to believe that *any* poet who has lived with birches could possibly rhapsodize about them. For frankly—much as I hate to say it—as a tree growing in a suburban yard, the white birch is a *mess*. One of its worst features is that it serves as a happy home for untold millions of aphids. These aphids naturally and inevitably, drop off onto cars parked nearby, onto outdoor furniture, or passing people. Minute droplets of sap also have a sticky habit of showering down from birch leaves and branches. Of course, if these things happen to wild birches, no one is annoyed or even aware of it, but in an outdoor livingroom such hazards mar the serenity of even the most heavenly of days. To be sure a prolonged "washing down" of the offending trees by a vigorous stream of water from the family garden hose will provide some relief. But it is only slight and temporary at best.

Another bad point about the birches is their leaning or drooping tendency. It is true that they do bend far

down without breaking under a load of snow or freezing rain—almost as if they had rubber in their make-up. But, unfortunately, the ultimate recovery, when the ice and snow melt, is never quite complete, and the "permanent set," taking place presents an ever increasing problem until finally the trees bend down so far that removal is obligatory. Birches also tend to drop their leaves unless amply supplied with water, and during severe droughts often lose their entire foliage. If this happens twice in succession during a single season, the tree dies . . . Another source of annoyance inherent with birches is the myriads of minute seeds hanging from the branches for months on end in both staminate and pistillate catkins. As these clusters gradually break up, the various tiny seed parts find their way all over the yard, as well as into every corner of the house.

To summarize: a birch on an open hillside, on the bank of a woodland stream, or far from the habitation of man is a glorious, noble and inspiring sight. But, as a shade or ornamental tree on the average home lot it leaves a great deal to be desired. If you have a chance to choose, take something else instead. Messrs. Coleridge, Keats, or Shelley to the contrary, this is one time when, "A thing of beauty is (NOT) a joy, forever. . . ."

Plastic Shotgun Shells

Remington Arms Co. has continued its spectacular use of plastics in the products which it manufactures for the hunting trade, with its new, "SP" shotgun shell. The "SP" (steel-polyethylene) shell differs from the conventional product in two main particulars. These are the substitution of polyethylene for paper in the wadding and body, and the replacement of brass by steel for the caps.

Weatherproofness is said to be greatly improved by the use of specially processed linear polyethylene for the shell casing. This guards against moisture while the shell is in use as well as during storage under elevated temperatures and conditions involving high humidity. Since the plastic body remains dimensionally stable under these severe conditions, the shells "chamber" perfectly. This is not true of the conventional product made with a wax-treated, paper body. An additional plus for the new Remington item is that the use of the translucent plastic makes it possible to see at a glance whether or no the shell contains a proper charge of shot and wads. *Plastics World*, however, in reporting Remington's brain child, is careful to point out that this is merely an incidental feature of the new item. In fact, it unhappily destroys the age-old alibi of, "no shot in that shell," occasionally used by sportsmen to explain hunting misses.

The use of steel in the new shell provides increased strength. Since the steel does not require knurling, the shell is smoother. It therefore slides in and out of the gun chamber more perfectly. Also eliminated is the cracking sometimes encountered with brass under certain climatic conditions.

Newspaper Boys

Newspaper boys come in a variety of ages, sizes, shapes, and colors. However, all can be classified in two main groups.

The first includes the youngsters who "own" paper routes, and singlehandedly, deliver their daily periodicals to each customer's home. This is done in a careful, considerate and thoroughly satisfactory manner. Such training evidently helps to develop courage, integrity, and a host of other important virtues in these growing youths, for it is an unquestioned matter of record that an overwhelming number of leaders in all walks of life were themselves paper boys at one time.

The other class of "paper boys" are those employed by an operator who has a contract to deliver daily papers to the homes of a number of suburbanites. These young men ride a truck carrying the papers, hop off when near the various delivery points, and hurl the tightly wrapped paper in the general direction of the house in question. Bushes, asphalt driveways, trees, concrete steps, muddy slopes, etc., always rear their ugly heads and prevent the paper from reachings its home haven. These objects also inevitably chew chunks of newsprint from pages 1, 2, and 3, or at least smear them beyond recognition. It sometimes seems that these wild pitchers must be working for an industry prize—perhaps a plaque, honoring the one who consistently wrecks the most reading matter in a given time.

In pondering the above phenomena, several questions present themselves. One: could it be—as the boys cling to the trucks—heads buried inside and posteriors exposed outside—they are so shaken and jounced about, like astronauts, that they are punch drunk when they hit the ground? . . . Wild pitches would naturally result. Or could it be that the boys become frustrated at being neither businessmen nor car operators? Emotional instability could readily follow.

In any case, the entire subject clamors for a sympathetic study, and a speedy solution. A psychiatrist might be the answer.

Signs of the Times

A laconic statement in the financial section of various New York newspapers dated October 18, 1960, reads as follows. "Comptometer Corp. said yesterday it has agreed to buy Worthington Ball Co. of Elyria, Ohio, manufacturers of golf balls, for an undisclosed cash sum."

This can only mean one thing. Golf balls are to be constructed with built-in counting devices in their innards. No longer will it be possible for the carefree hacker to accidentally lose track of a few errant strokes in the bushes or traps. Instead everything will be a matter of tragic record. Perhaps, in the long run, it's all for the best, but in the beginning those high scores could be hard to digest. Especially if one of your favorite golfing cronies was the one who insisted that you use the new ball!

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coming events

1960

Nov. 16. Quebec Rubber & Plastics Group, Joint Meeting with Montreal Section, Chemical Institute of Canada, Montreal, Quebec, Canada.

Nov. 17. New Products Industrial Symposium, Sponsored by Quantum, Inc., Yankee Silversmith Inn, Wallingford, Conn.

Nov. 18. Rubber Science Hall of Fame Symposium, Co-sponsored by the University of Akron and Akron Rubber Group, University of Akron, Akron, Ohio.

Nov. 18. Chicago Rubber Group, Technichal Meeting, Furniture Club, Chicago, Ill.

Nov. 18. Connecticut Rubber Group, Rapp's Paradise Inn, Ansonia, Conn.

Nov. 22. Manufacturing Chemists' Association, 10th Semi-Annual Meeting and Mid-Year Conference, Statler Hilton Hotel, New York, N. Y.

Nov. 25. Rubber Chemicals Salesmen's Association of Akron, University Club, Akron, Ohio.

Nov. 28-Dec. 2. American Society of Mechanical Engineers, Annual Meeting, Statler Hilton Hotel, New York, N. Y.

Nov. 29. New Products Industrial Symposium, Sponsored by Quantum, Inc., Harvard Club, Boston, Mass.

Nov. 30-Dec. 2. British Plastics Federation, 2nd International Reinforced Plastics Conference, Cafe Royal, London, England.

Nov. 30-Dec. 2. Ninth Annual Wire & Cable Symposium, Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 1. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Dec. 2. Akron Polymer Lectures, "Single Crystals and Folding of Macromolecules," University of Akron, Akron, Ohio.

Dec. 3. Northern California Rubber Group, Christmas Party, Orinda, Country Club, Orinda, Calif.

Dec. 3-9. Chemical Specialties Manufacturers Association, 47th Annual Meeting, Hollywood Beach Hotel, Hollywood, Fla.

Dec. 4-7. American Institute of Chemical Engineers, Annual Meeting, Statler Hilton Hotel, Washington, D. C.

Dec. 5-8. Third National Conference on the Application of Electrical Insulation, Conrad Hilton Hotel, Chicago, Ill.

Dec. 6. Ontario Rubber Group, Winter Meeting, Prudhomme's, Grimsby, Ontario, Canada.

Dec. 8. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Dec. 8. Synthetic Organic Chemical Manufacturers Association, Annual Meeting, Hotel Roosevelt, New York, N. Y.

Dec. 9. Detroit Rubber & Plastics Group, Christmas Meeting, Statler Hilton Hotel, Detroit, Mich.

Dec. 9. Los Angeles Rubber Group, Christmas Party, Beverly Hilton Hotel, Beverly Hills, Calif.

Dec. 10. Southern Ohio Rubber Group, Christmas Party, Miami Valley Golf Club, Dayton, Ohio.

Dec. 11-14. American Nuclear Society, Mark Hopkins Hotel, San Francisco, Calif.

Dec. 12-15. Atomic Industry Exhibition, California Masonic Memorial Temple, San Francisco, Calif.

Dec. 12-15. Industrial Building Exposition and Congress, New York Coliseum, New York, N. Y.

Dec. 13. Buffalo Rubber Group, Christmas Party.

Dec. 16. Boston Rubber Group, Christmas Party, Somerset Hotel, Boston, Mass.

Dec. 16. Chicago Rubber Group, Christmas Party, Morrison Hotel, Chicago, Ill.

Dec. 16. New York Rubber Group, Christmas Party, Henry Hudson Hotel, New York, N. Y.

Dec. 26-31. American Association for the Advancement of Science, Annual Meeting, New York, N. Y.

1961

Jan. 6. Akron Polymer Lectures, "Application of Differential Thermal Analysis to High Polymers," University of Akron, Akron, Ohio.

Jan. 9-11. National Symposium on Reliability and Quality Control, Bellevue Stratford Hotel, Philadelphia, Penna.

Jan. 9-13. Society of Automotive Engineers, International Congress and Exposition of Automotive Engineering, Convention Center, Detroit, Mich.

Jan. 10. Ontario Rubber Group, Technical Meeting, Clover Leaf Hotel, Toronto, Ontario, Canada.

Jan. 16-19. Instrument Society of America, Winter Instrument-Automation Exhibit, Sheraton Jefferson Hotel and Kiel Auditorium, St. Louis, Mo.

Jan. 19. Quebec Rubber & Plastics Group, Technical Meeting.

Jan. 20-21. Southern Rubber Group, Statler Hilton Hotel, Dallas, Texas.

Jan. 24-27. Society of Plastics Engineers, 17th Annual Technical Conference, Shoreham and Sheraton Park Hotels, Washington, D. C.

Jan. 27. Akron Rubber Group, Technical Meeting, Sheraton Hotel, Akron, Ohio.

Jan. 27. Chicago Rubber Group, Technical Meeting, Furniture Club, Chicago, Ill.

Jan. 28-Feb. 1. National Automobile Dealers Association, 44th Annual Convention, San Francisco, Calif.

Jan. 30-Feb. 3. American Society for Testing Materials, Committee Week, Netherland Hilton Hotel, Cincinnati, Ohio.

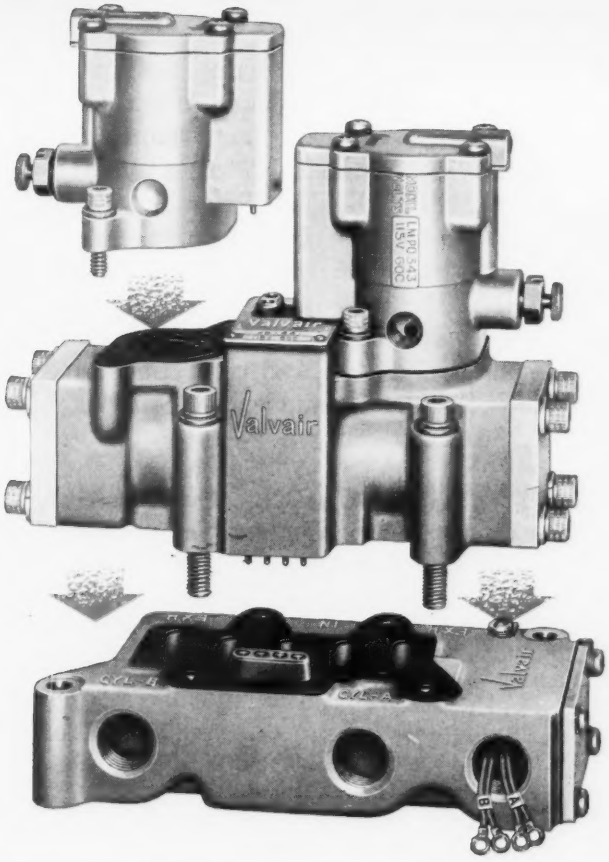
Jan. 30-Feb. 2. Plant Maintenance and Engineering Show, International Amphitheatre, Chicago, Ill.

Feb. 1-3. Committee D-11 on Rubber and Rubber-Like Materials, ASTM, Netherland Hilton Hotel, Cincinnati, Ohio.

Feb. 3. Akron Polymer Lectures, "Some Aspects of Anionic Polymerizations," University of Akron, Akron, Ohio.

Feb. 3-5. Boston Rubber Group, Ski Weekend.

Feb. 7. Los Angeles Rubber Group, Technical Meeting.



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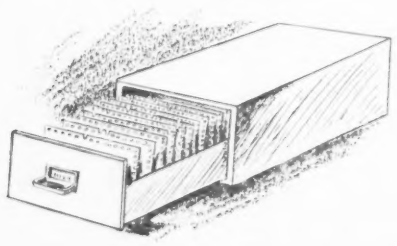

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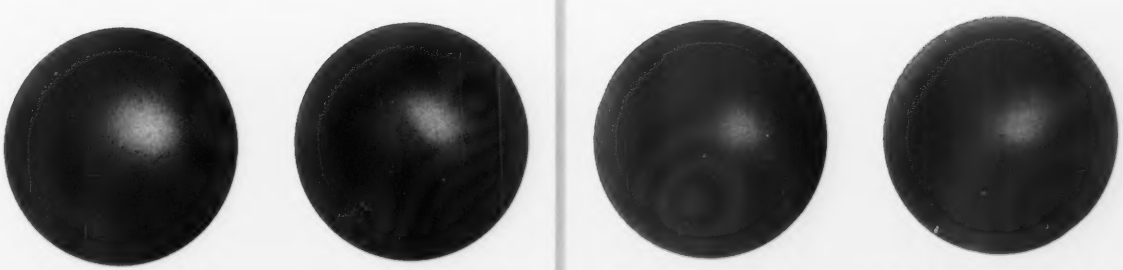

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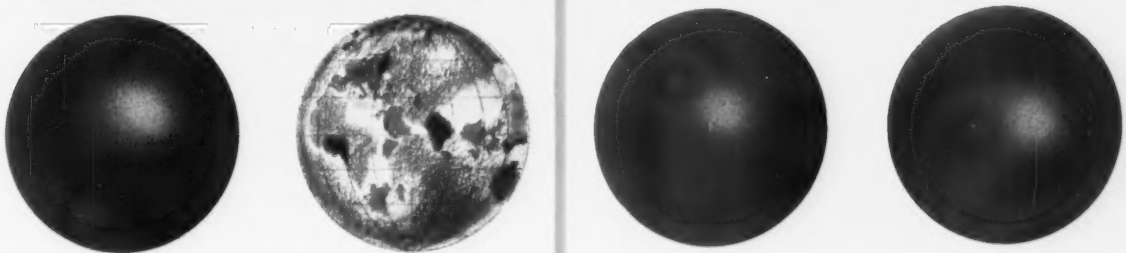

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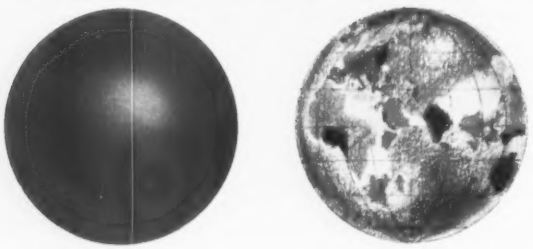
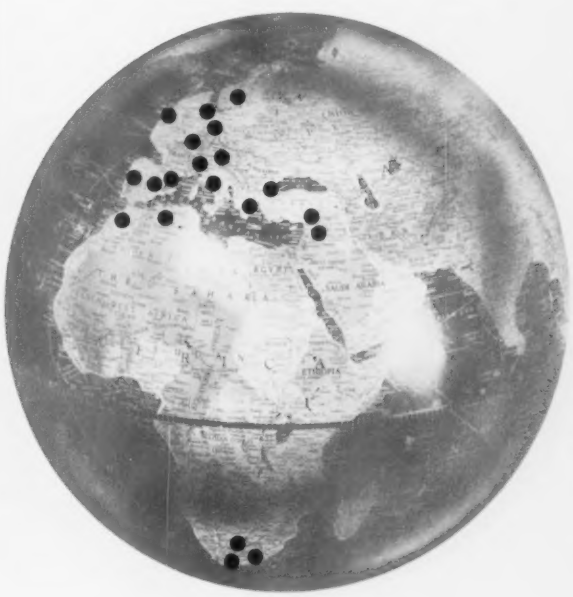


OVER

Cabot's revolutionary new Regal oil furnace blacks are now saving money, speeding service for rubber producers the world over. Here is how and why it's happened.....

Introduced only 6 months ago, Cabot's new REGAL blacks are already in commercial production in Australia*, Canada, England, France, Italy..and of course, the U. S. A.

*Regal 300, Regal 600 and Regal SRF are Acarb® 300, Acarb® 600 and Acarb® SRF



Introduced only 6 months ago, Cabot's new **REGAL** blacks are already in commercial production in Australia*, Canada, England, France, Italy..and of course, the U. S. A.

*Regal 300, Regal 600 and Regal SRF are Acarb® 300, Acarb® 600 and Acarb® SRF

Why the overwhelming accepta

Because noth
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of better service,
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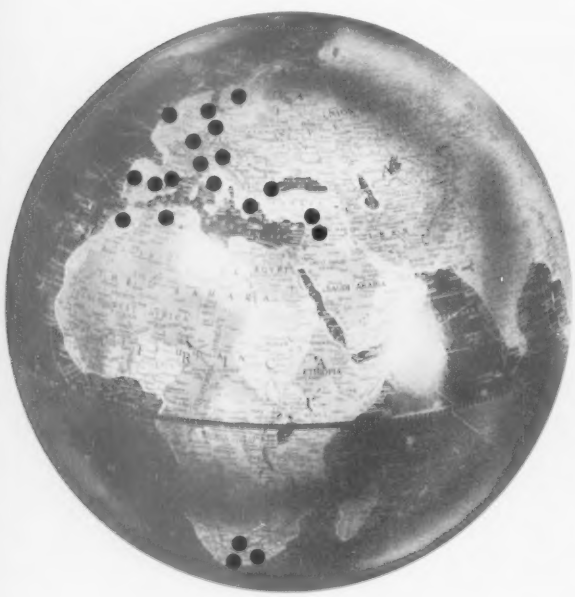
increased economy.



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Consider service, for instance.

Cabot's new Regal 300, offered as a channel black replacement, and new Cabot Regal SRF, offered as a replacement for gas-produced SRF are now being produced overseas.

That means faster, more efficient delivery than would be possible by importing U. S. gas-produced blacks. It means a channel black replacement and SRF black now available for sale in Australian and British pounds, in Canadian dollars, French francs, and Italian lire. And it also means that the price cannot be affected (in the U. S. or elsewhere) by the ever-rising cost of natural gas.

But that's not all. Let's take a look at the performance and the economy of these new Regal blacks.

Regal 300, for instance. It's the first oil furnace black ever developed specifically to replace premium-priced channel blacks. It has all the wear and tear resistance of the black it replaces, and it costs less. And in addition it features the faster curing rate of HAF types.

Regal 600, for instance. Here's something totally new in oil furnace blacks, developed to meet the changing requirements of rubber manufacture. It combines low hardness with high tread wear resistance as no carbon black of any type has ever done before. And most important, it delivers better performance in tire treads and tread rubber by combining low hardness and low modulus to give a quieter ride and superior traction.

Regal SRF, for instance. It matches or excels the performance characteristics of gas-produced SRF blacks. But for overseas producers especially, it's a much better buy. The reasons: convenience and economy. Overseas buyers no longer have to import U. S.-produced SRF blacks at U. S. dollar cost.

Better service, better performance, added economy . . . these are the yardsticks by which all Cabot efforts are measured. And, thanks to Cabot's unremitting program of planned progress through research, these three Regal blacks are only the harbingers of still better things to come.

FREE SAMPLES AND COMPLETE TECHNICAL INFORMATION AVAILABLE FROM ALL CABOT OFFICES

CABOT CORPORATION, 125 High Street, Boston 10, Massachusetts

Please send free sample and complete technical data on
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- ☐ Regal 600
- ☐ Regal SRF

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...THE WIDE WORLD OVER REGAL GOOD NEWS

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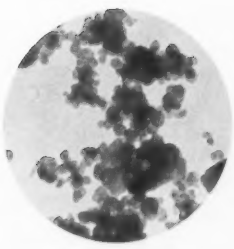
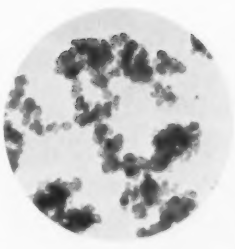
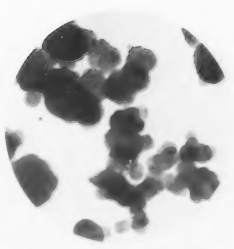


Regal 300



Regal 600



Regal SRF

MORE NEW REGAL BLACKS COMING

Regal 300, Regal 600, and Regal SRF are only the first of a whole family of new type oil furnace blacks to come.

The Cabot variety of oil furnace blacks will continue to be extended to include quality grades never before made available. Thus, Cabot will continue to assure an uninterrupted supply of carbon blacks for all purposes, world-wide, from raw materials not subject to the economic pressures affecting natural gas, and at locations where there is no natural gas.

Regal is another notable first for Cabot, world's largest producer and seller of carbon black, industry leader for 78 years.

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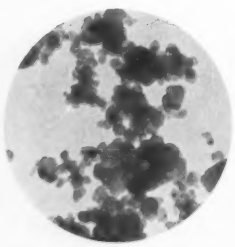
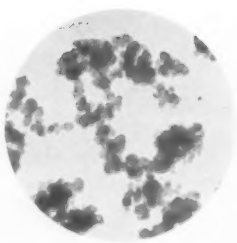
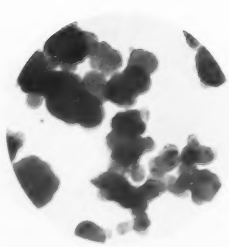


Regal 300



Regal 600



Regal SRF

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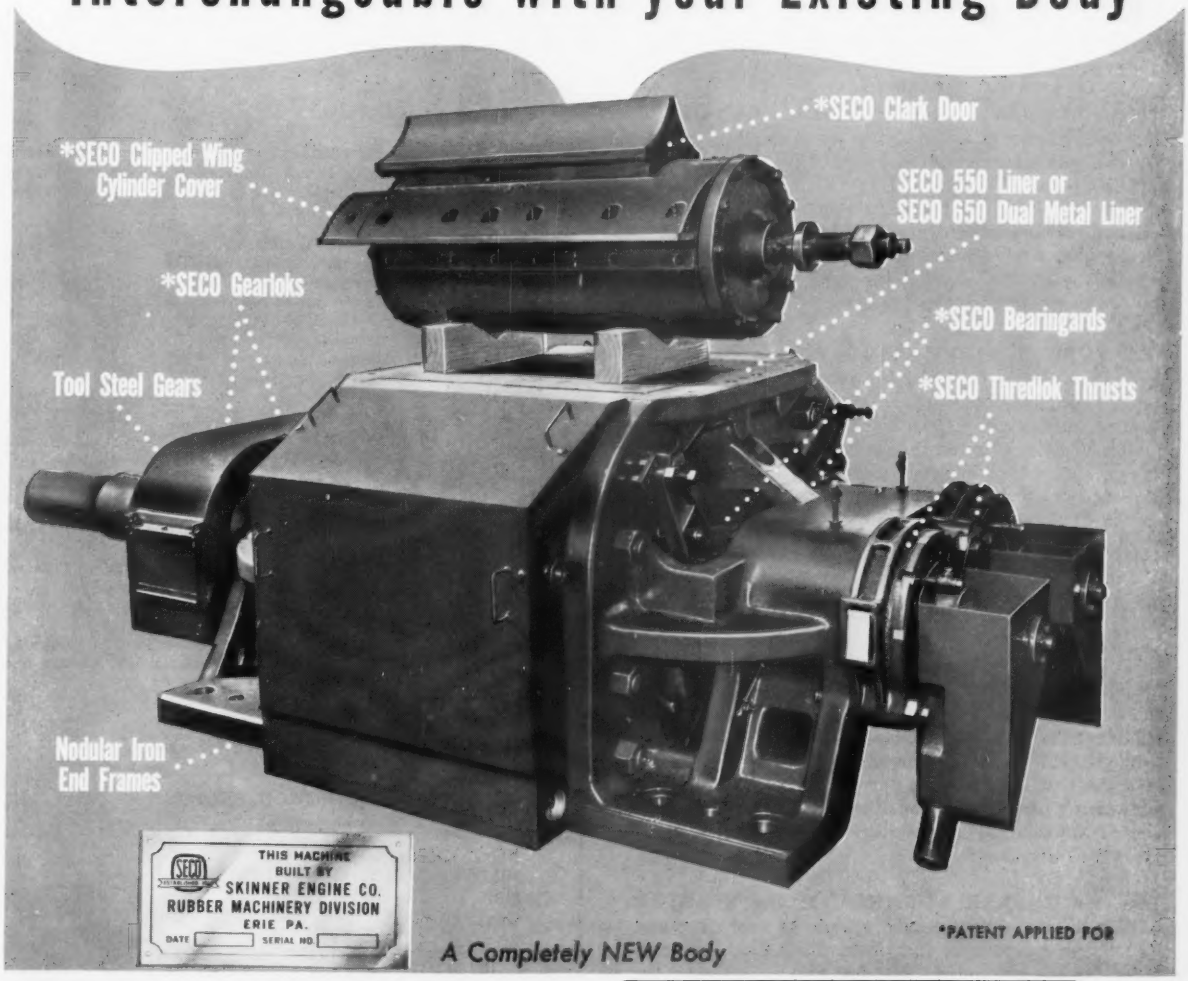
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276	"	for styrene rubber, black
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259	"	for nitrile rubber, black
97	"	for nitrile rubber, nonblack
254	"	for neoprene, black
116	"	for neoprene, nonblack
101	"	for butyl, black
57	"	for butyl, nonblack
50	"	for polysulfide, black and nonblack
36	"	for reclaim (all black compounds)
45	"	for Hypalon, black and nonblack
86	"	for silicone rubber, black and nonblack
92	"	for vinyls (all nonblack compounds)
100	"	for miscellaneous other rubbers, black and nonblack
156	"	for blends of general purpose rubbers (natural, styrene, butyl, reclaim), black
71	"	for blends of general purpose rubbers, nonblack
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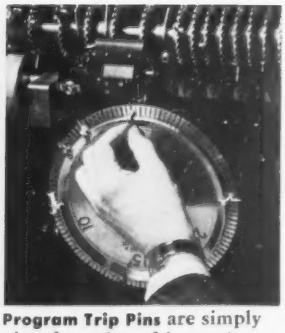

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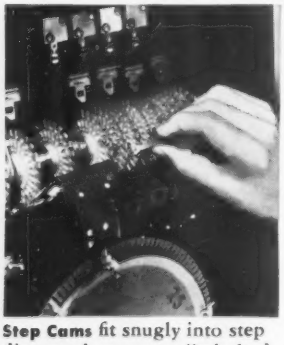

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- Extremely short time intervals between steps (with high accuracy) can be accommodated . . . 7½ seconds on 30 minute cycle dial; minimums on other dials in same ratio.
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- Time dial automatically resets to zero in maximum of 13 seconds at completion of cycle.

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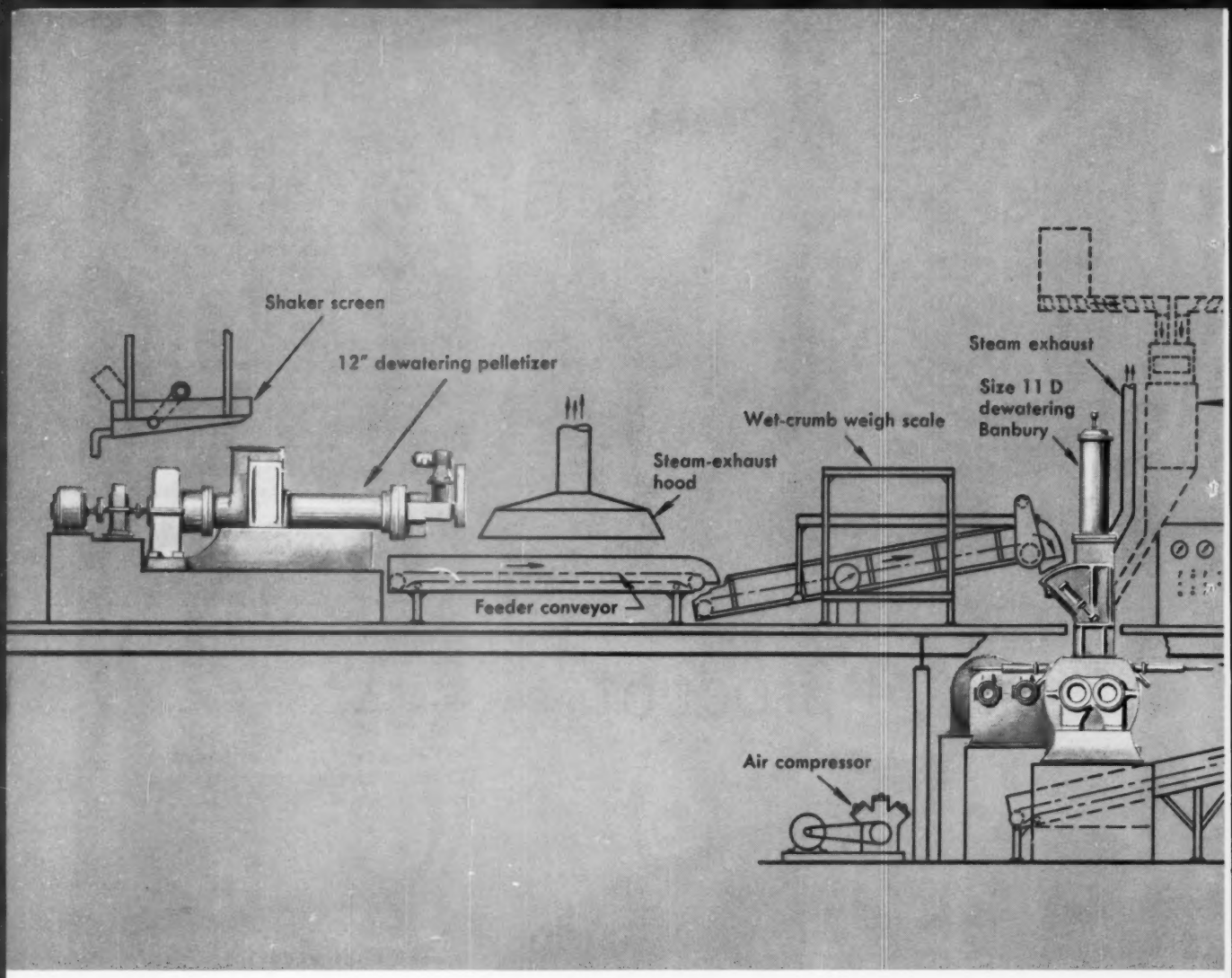

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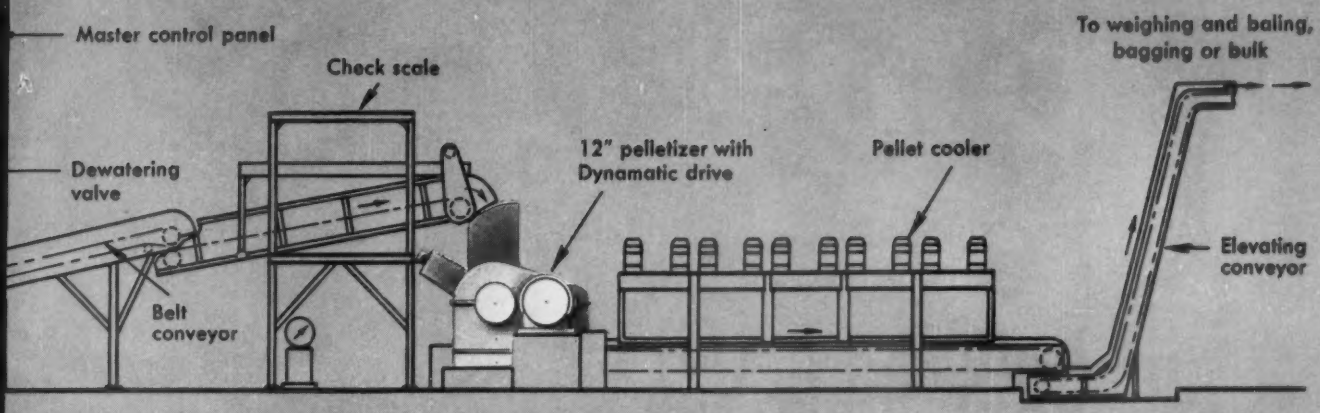

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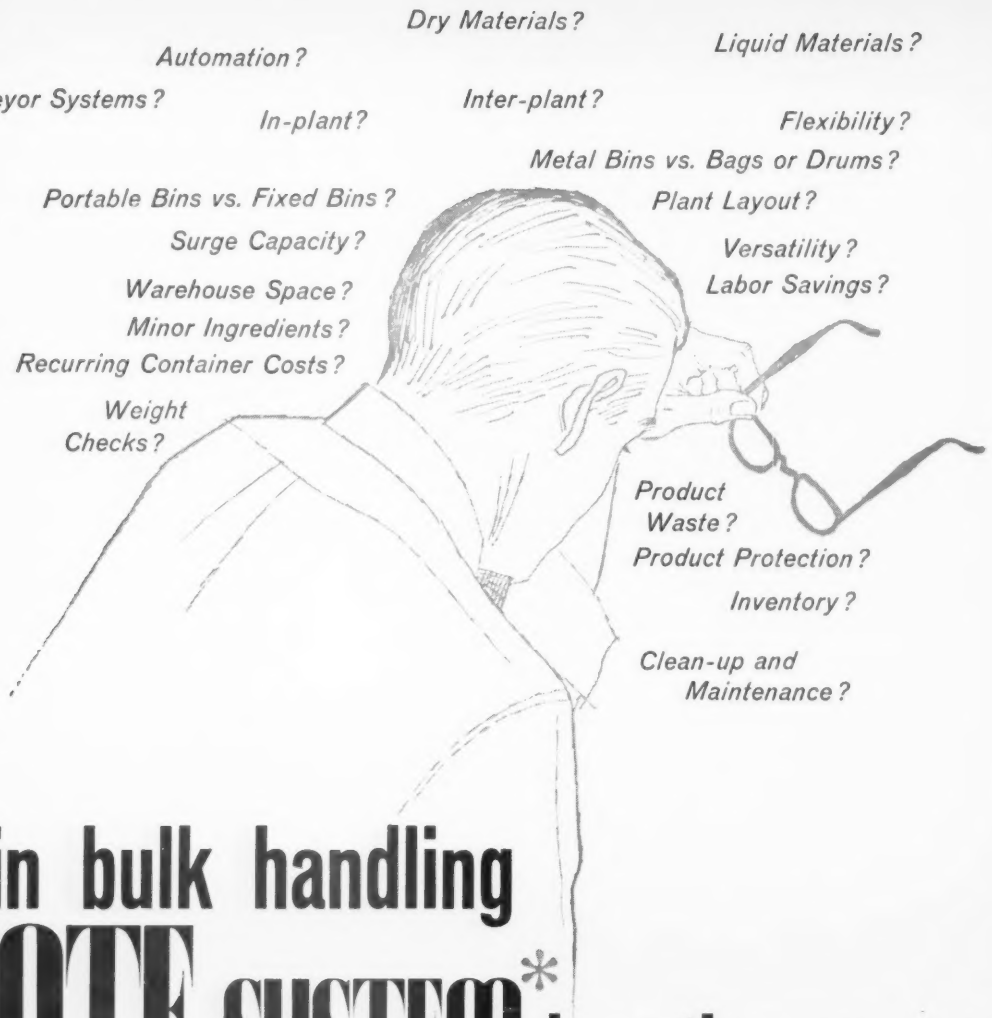

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RUBBER AGE/VOL. 88, No. 2/November, 1960

The Role of CARBON BLACK in the Thermal Oxidation of Polyolefins

By W. L. HAWKINS, M. A. WORTHINGTON and F. H. WINSLOW
Bell Telephone Laboratories, Murray Hill, N. J.

CARBON black has been an important additive for polyolefin polymers since Wallder and his coworkers *(1)* demonstrated its effectiveness as a light screen in protecting polyethylene against photooxidation. It has not been as widely recognized, however, that carbon black plays a significant role in thermal oxidations. It may function as an effective antioxidant in its own right *(2)*, or it may influence the reactivity of other antioxidants rendering some less *(2)* and others more effective *(3)*. Investigation of the role of carbon black in thermal oxidation may contribute both to our knowledge of carbon black chemistry and to the mechanism of autoxidation.

Three per cent of commercial channel blacks, 300A or less in particle size, inhibits the thermal oxidation of polyethylene at 140°C. for 40 to 50 hours as compared with several hundred hours for 0.1 per cent of a good organic antioxidant. The ability to terminate oxidation reactions, however, is dependent on the presence of reactive groups on the carbon surface, and the effectiveness may be substantially increased by reactions which form additional functional groups. Carbon black may be activated by heating in air at 600°C. with an accompanying increase in both acidity and chemically combined oxygen. Activation of a typical channel black (5 to 6 per cent oxygen) to an oxygen content of 18 per cent increases the effectiveness to such an extent that it is comparable with the better organic antioxidants (Figure 1). When the oxygen-containing groups are removed through pyrolysis in vacuum or in a nitrogen atmosphere, carbon black will no longer inhibit thermal oxidation.

The exact nature of the oxygen group or groupings responsible for antioxidant activity of carbon black is still in doubt. The work of Studebaker *(4)*, Hallum and Drushel *(5)*, Garten and Weiss *(6)* and others indicates the presence of a variety of functional groups containing oxygen on the surface of carbon particles. There is evidence for phenol, quinone, lactone and carboxyl groups. Of these only the phenolic hydroxyl is commonly found in antioxidants capable of inhibiting the thermal oxidation of polyolefins. Indirect evidence that this group is responsible for antioxidant activity is found in our recent observation that an activated carbon black, after repeated methylation with diazomethane (a reagent which converts acidic hy-

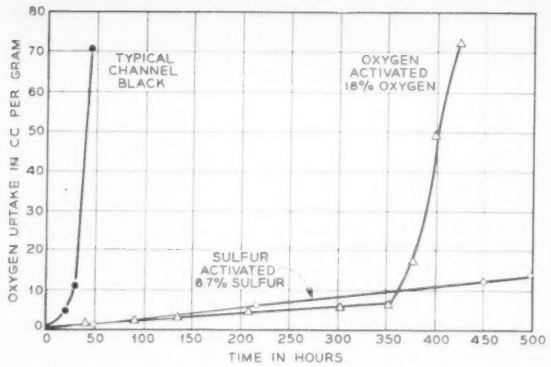

FIG. 1—Activated carbon blacks as antioxidants for polyethylene.

Carbon black performs a varied and important role in the thermal oxidation of polyolefins in addition to functioning as a light screen. It is a mild inhibitor, and has a significant influence on the behavior of most antioxidants. The ability, exhibited by many carbon blacks, to inhibit the free radical oxidation of polyolefins is dependent on the presence of certain reactive groups on the surface of the carbon particles. Heating in the presence of oxygen or sulfur increases the number of reactive groups to produce a much more effective antioxidant. Polyethylene modified with sulfur-activated carbon black oxidizes at a slow, steady rate without becoming autocatalytic. Antioxidants such as secondary amines and alkylated phenols lose much of their effectiveness in the presence of carbon black. Certain organic sulfur compounds, however, are even more effective in the presence of carbon black than in clear polymer.

droxyls into ether groups) loses most of its effectiveness as a thermal antioxidant. However, this does not rule out the possibility that quinone groups may be involved since diazomethane also modifies this group through formation of a heterocyclic ring.

It has also been found, as shown in Figure 1, that heating mixtures of carbon black with elemental sulfur produces an active form of carbon. By analogy with oxygen activation, this reaction may introduce thiol groups or possibly thioquinones on the carbon surface. Oxidation of polyethylene protected with sulfur-activated carbon black takes place at a slow, constant rate with no evident autocatalysis.

Carbon Black As Catalyst

It has been suggested *(7)* that the role of carbon black in inhibiting thermal oxidation involves the catalytic decomposition of peroxides. Carbon blacks do catalyze the decomposition of cumyl hydroperoxide at 95°C. as shown in Figure 2 with the high oxygen carbons showing the greatest effect. Furthermore, this catalysis is also dependent on groups which are reactive toward diazomethane since carbons treated with this reagent are substantially less effective in peroxide decomposition. Further study on the effect of various modifications of surface groups through chemical reaction may resolve the uncertainty as to the exact group(s) responsible for antioxidant activity of carbon blacks.

Although carbons which have not been activated do not compare favorably with good organic antioxidants under accelerated (140°C.) test conditions, their relative effectiveness is much greater at lower temperatures. A relationship exists between protection, as measured by length of the induction period, and temperature for an uninhibited polyethylene. The induction period is defined in time units as the intercept of the extrapolated steady-state rate with the time axis.

As shown in Figure 3, this relationship is a linear function with no apparent change in slope in passing through the polymer melting range. Ionol, a typical organic antioxidant, shows a similar relationship as do all of the molecularly-dispersed antioxidants studied over a temperature range. *(8)* Carbon black, however, gives an increasing degree of protection with decreasing temperature, diverging from linearity at the temperature range over which the polymer becomes molten. Thus carbon black, even without activation, is a very effective antioxidant for polyethylene in the solid state.

The fact that large, discreet particles of carbon black can function as an antioxidant in a polymer matrix where molecular motion and hence that of

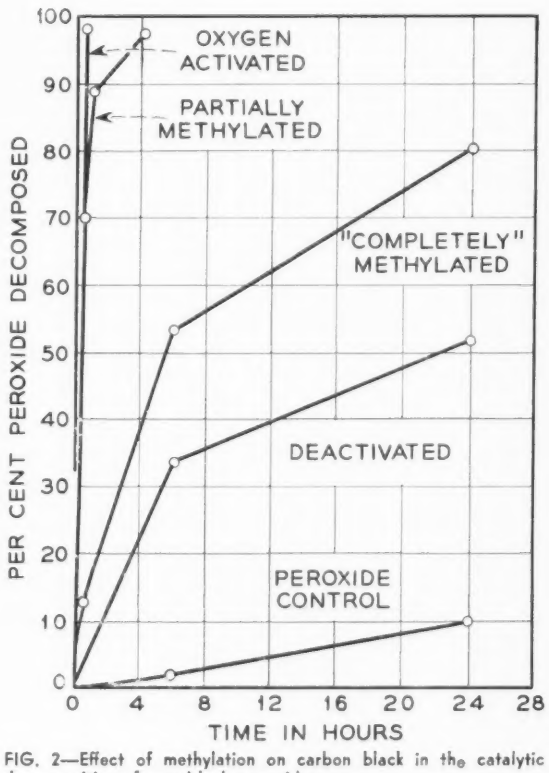

FIG. 2—Effect of methylation on carbon black in the catalytic decomposition of cumyl hydroperoxide.

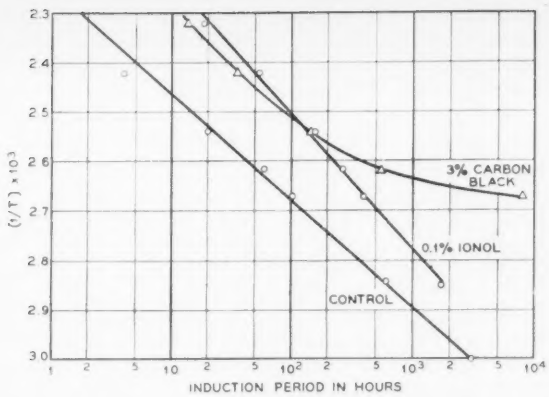

FIG. 3—Effect of temperature on the oxidation of branched polyethylene containing various protectants.

propagating radicals is restricted, even in the melt, could be explained in several ways. One possibility is that some low molecular weight compound(s) migrates from the carbon surface through the polymer and that this is the actual antioxidant. However, exhaustive evacuation up to 200°C. failed to reduce the antioxidant activity of carbon black. Apparently, termination of the oxidation chains takes place on the surface of the carbon particle. This conclusion is compatible with our observation that an increase in the number of functional groups on the carbon surface produces a more effective antioxidant.

Density Gradient Data

The increased effectiveness of carbon black as an antioxidant below the polymer melting range is related to the semicrystalline nature of the polymer. Branched polyethylene prepared by the original, high pressure method is only about 60 per cent crystalline in the solid state. Exhaustive oxidation and other studies *(9)* have demonstrated that oxidation is confined to the amorphous region. Density gradient data shown in Figure 4 and X-ray observations indicate that the ratio of amorphous to crystalline region is essentially the same in carbon black-polyethylene mixtures as in the clear polymer.

Unlike small antioxidant molecules, carbon particles are immobile in the molten polymer. Therefore, the average distance that a polymer oxidation chain must travel to reach the carbon surface and be terminated is less in the solid than in the molten polymer, shown schematically in Figure 5. Formation of crystallites excludes more than half of the polymer volume from oxidation. This is tantamount to an increase in carbon black concentration in respect to the amorphous volume, which explains the improved effectiveness of carbon black below the polymer melting point.

Molecularly dispersed antioxidants on the other hand can and do migrate throughout the molten polymer. The observed linear relationship between temperature and concentration with this type of antioxidant implies that the same concentration of antioxidant exists in the amorphous region both above and below the polymer melting point.

Figure 6 shows the data obtained by oxidizing a linear and a branched polyethylene, each containing 3 per cent carbon black, over a temperature range. In both polymers the effectiveness of carbon black increases with decreasing temperature, but divergence from linearity is observed at approximately the melting range of the individual polymer.

In many commercial applications where polyethylene is to be exposed to outdoor weathering for long periods, it is customary to add both carbon black as the ultraviolet screen and an organic antioxidant to inhibit thermal oxidation. Hawkins, Hansen, Matreyek and Winslow *(2)* have shown that many of the common phenol and amine antioxidants function much less effectively in the presence of carbon black than in the clear polymer. Originally this loss in effectiveness was attributed to simple adsorption of the antioxidant on the carbon surface. However, antioxidants themselves are susceptible to oxidation *(10, 11, 12, 13, 14)*.

Although it has not been possible to observe the direct oxidation of antioxidants in polyethylene, the catalytic effect of carbon black on antioxidant oxidation can be demonstrated in inert solvent. The effect of various carbon blacks on the oxidation of a typical phenol is summarized in Figure 7. Oxygen activated carbons are slightly more effective catalysts than the untreated channel blacks. In an oxidizing substrate such as polyethylene, antioxidant effectiveness may be reduced through increased catalytic oxidation on the carbon surfaces and/or through simple adsorption which would have the effect of restricting free migration of the protectant through the polymer mass.

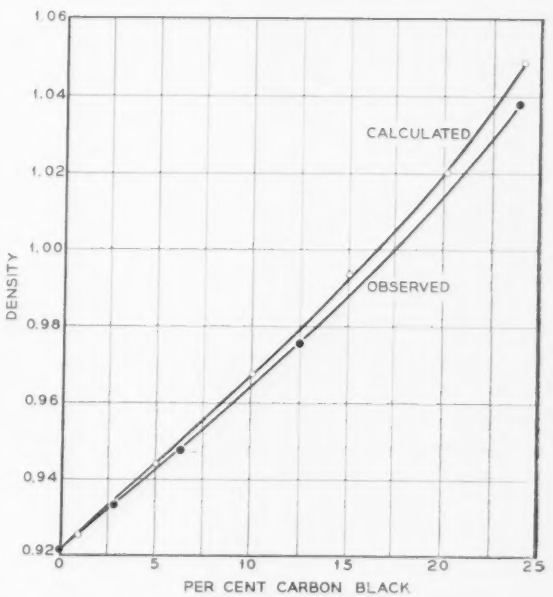

FIG. 4—Density of carbon black—polyethylene mixtures.

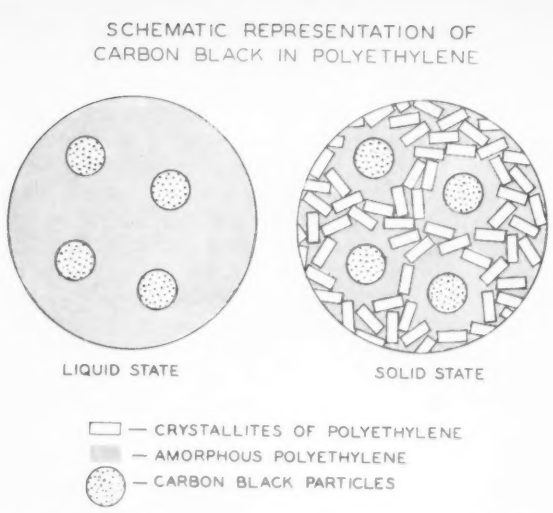

FIG. 5—Schematic representation of carbon black in polyethylene.

Recently, new antioxidants have been developed *(3)* which are not adversely affected by carbon black. These differ from conventional antioxidants in that they contain sulfur either as a thiol, thioether or polysulfide group. The difference in the effect of carbon black on these two classes of antioxidants is shown in Figure 8.

Homologue Differences

The only difference between 2, 2′-methylenebis-(4-methyl-6-*tert*-butyl phenol) and its thiobis homologue is the group which joins the aromatic moieties; the former contains a methylene bridge and the latter a thioether bridge. The methylenebis compound loses most of its effectiveness in the presence of carbon black whereas the thiobis homologue exhibits a synergistic effect with carbon black.

Furthermore, the oxidation rate of polyethylene inhibited with the combination of carbon black and 2, 2′-thiobis-(4-methyl-6-*tert*-butyl phenol) is not autocatalytic after 900 hours. In this respect the combination resembles sulfuractivated carbon black. This type of rate curve without evident autocatalysis has been observed *(3)* with several other sulfur-organo antioxidants in the presence of carbon black and may indicate that these protectants function through a mechanism different from that suggested for conventional antioxidants *(15)*.

Carbon Black Versatility

A further example of the versatile role of carbon black in thermal oxidation is found in our observations *(3)* that several types of sulfur compounds which, though essentially ineffective in clear polyethylene, become good antioxidants in combination with carbon black. Thio-β-naphthol and carbon black, for example, restrict oxidation of polyethylene to a slow, constant rate for over a thousand hours at 140°C. although the thiol is ineffective in clear polymer at this temperature. The various types of sulfur compounds which have been shown to be antioxidants in combination with carbon black are summarized in Figure 9.

The mechanism through which these compounds function synergistically with carbon black has not been established. There is evidence, however, that the functional group(s) on the carbon surface which is responsible for the antioxidant activity of carbon black and its adverse effect on conventional antioxidants is not involved in the reaction. Thus pyrolysis and methylation with diazomethane do not nullify the ability of carbon black to function synergistically with sulfur-organo antioxidants. Investigation of the unique reaction between carbon black and organo-sulfur compounds is continuing.

Carbon black dispersions are excellent protectants against photo-oxidation of polyethylene. It is now apparent that its value as a thermal antioxidant at lower temperatures is greater than was previously estimated. Activation with oxygen or sulfur greatly increases the effectiveness as a thermal antioxidant. Unfortunately carbon black interferes with the pro-

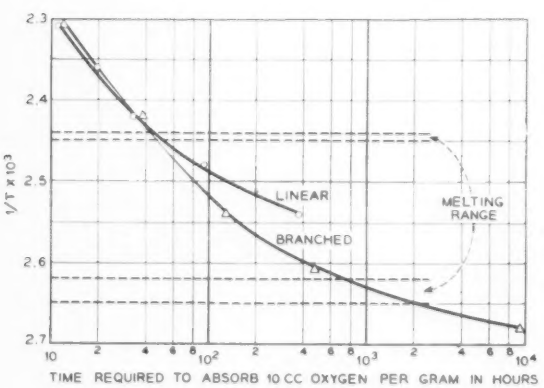

FIG. 6—Effect of temperature on branched and linear polyethylenes modified with 3 per cent carbon black.

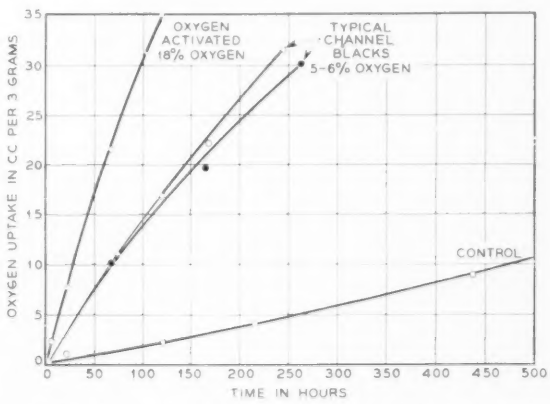

FIG. 7—Oxidation rate of 2, 6-di-*tert*-butyl phenol in the presence of various carbon blacks.

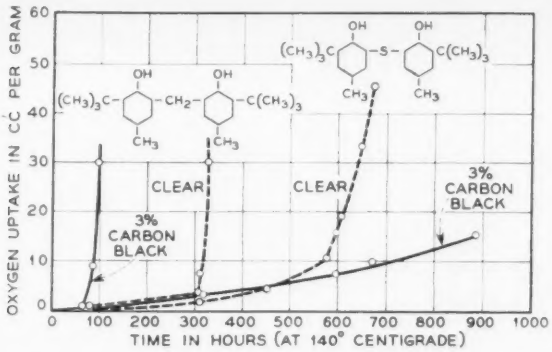

FIG. 8—Comparison of 0.1 per cent 2,2' thiols—(4-methyl-6-*tert*-butyl phenol) with 0.1 per cent 2,2' methylenebis (4-methyl-6-*tert*-butyl phenol) as an antioxidant in polyethylene.

tection afforded by many organic antioxidants, but this disadvantage can be overcome by its use in combination with organic sulfur compounds.

While the role of carbon black in the oxidation of polyolefins is not fully understood, there is evidence that certain reactive groups on the surface account for its antioxidant properties and its catalysis of the oxidation of some organic antioxidants. Removal of these groups by pyrolysis or etherification renders the carbon black ineffective as an antioxidant, but does not nullify its ability to function synergistically with organo-sulfur compounds.

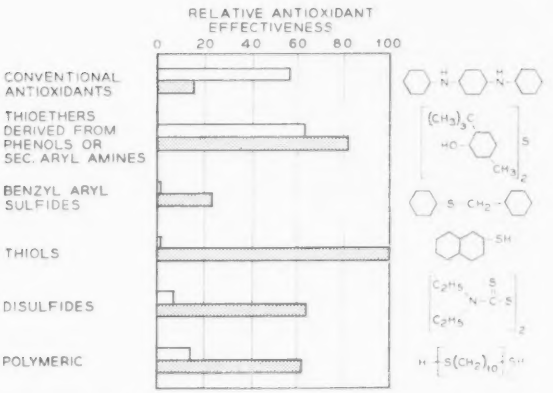

FIG. 9—Effect of carbon black on thermal antioxidants in polyethylene.

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RUBBER AGE

The Vulcanized-on-Sole Process:

COMPOUNDING

Second of a four-part series presents information on proper stock loading

By A. W. NICONCHUK
United Shoe Machinery Corp., Beverly, Mass.

OUR RESEARCH required vulcanizing fairly thick sections of elastomeric soling material in a minimum time with a singular, primary heat source. This led us into an intensive study of compounding techniques with complementary special studies. Compilation of complete wear-test data required an additional year. We will attempt to present only the highlights of our efforts, which should prove of interest to the rubber industry as a whole.

Production of high grade, non-marking soling compounds adaptable to the molded-on-process involved the following ten goals: (1) Complete cure in a minimum time cycle; (2) Good factory processing and reproducibility; (3) Good shelf life—a minimum of ten days at ambient temperature; (4) Non-blooming with age; (5) Adequate bond to uppers with commercial adhesives; (6) Good physical properties; (7) Good molding with varied pressure; (8) Adaptable to varied hardness; (9) Specific gravity below 1.40; and (10) Good shelf aging judged by simulated box storage in shoe outlets.

Our compounding investigation entailed testing of over 500 formulations with natural, SBR, NBR, NBR/vinyl, Butyl and polyurethane elastomers. Facets of the study are shown in Table I.

Generally speaking, elastomers are notoriously poor conductors of heat. Fillers which impart strength to rubber also improve heat conductivity.

Being concerned with optimum thermal conductivity, we performed a screening test aimed at selectivity of fillers. Prior to the arrival of the vulcanizing press (BUVP), we simulated heat transfer as shown in Figure 1. The bottom platen was maintained at 350° F. to compensate for lack of side mold heating and heat losses in an unconfined system. Time-temperature curves were plotted for gums and filled stocks.

The results are shown in Table II. It is interesting to note that gum rubber (No. 2 Smoked Sheet) reached a maximum of 175° F. at the rubber-leather interface at the end of a 12 minute heat cycle. Some of the soling stocks we developed reached 250° F. in a similar test. In subsequent studies we were able to correlate this test method with actual vulcanizing conditions in the BUVP. It was found that a soling stock that showed 80 per cent cure by the press method resulted in a 100 per cent cured sole in the BUVP (Figure 2).

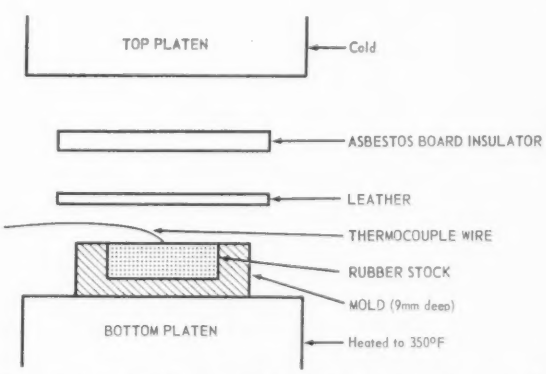


FIG. 1—Heat transfer was simulated with this press arrangement during the first phase of research.

FIG. 2—The shaded area indicates portion of sole cured by standard press method. New process cured the entire slab.

TABLE I—SPECIFIC COMPOUNDING STUDIES

	Natural	SBR	NBR	NBR/Vinyl	Polyurethane	Butyl
Non-Marking Stock	14	—	—	—	—	—
Curing Study	119	52	16	20	15	10
Rubber Peptizing	9	—	—	—	—	—
Microporous Sponge	5	—	—	—	—	—
Accelerator Study	40	—	—	—	—	—
Effect of Reclaims	19	—	3	—	—	—
Plasticity Study	40	117	—	5	—	—
General Compounding	157	7	63	5	15	10
Silicone Modification	—	10	10	—	—	—
Adhesive Study	13	11	12	—	—	—
Factory Runs						
BB Middleton	6	—	—	—	—	—
BB Cambridge	10	3	5	—	—	—
Hanover Rubber Co.	8	—	—	—	—	—
Heat Conductivity of Rubber	8	—	—	—	—	—
Heat Conductivity of Stocks	27	—	—	—	—	—
Scorch Tests	4	4	—	—	—	—
Moldability on Shoes	42	17	—	—	—	—
Abrasion Resistance	9	4	2	—	—	—
Hardness Control	16	15	—	—	—	—

Note 1: All stocks that showed promise were checked for sulfur bloom.

Note 2: Physical properties were determined for feasible stocks.

Preliminary screening of a few popular fillers is shown in Figures 3 to 6, representative of this type of study. Among the interesting points that may be noted: heat conductivity is a linear function of filler loading. Metallic-type fillers are better conductors than clays. Zinc sulfide, although a good conductor, has too high an S.G. (4.02) to be useful; zinc oxide falls into the same category.

Screening Studies

Furthermore, there is a 40° F. span in thermal conductivity between the poorest gum (polyurethane) and the best (NBR-Chemigum N-6). Finally, natural rubber is a much poorer conductor of heat than the common synthetics.

With the acquisition of the BUVP, filler screening studies were continued on a more practical basis under actual vulcanizing conditions. Our efforts pointed to the following fillers for best physical properties in the cured sole:

- Hydrated, precipitated calcium silicate giving excellent reinforcing properties;
- Basic magnesium carbonate promising fast cure with natural rubber;
- Hard clay (hydrated aluminum silicate) for reinforcing and ease of processing.

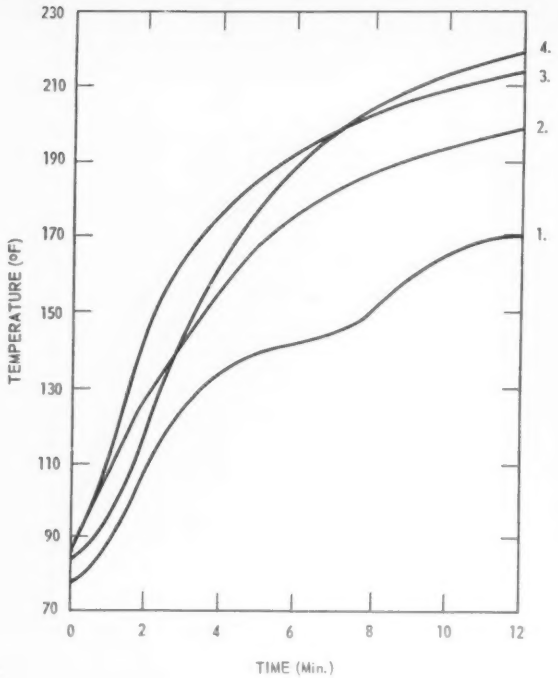
A blend of these three fillers proved very effective in soling compositions of natural rubber.

Plasticizers for natural rubber fall into two categories: true softeners, which dissolve in rubber—e.g., fatty acids, asphalts, pine tar and cumarone-indene; lubricants, such as oils, waxes and resins. A plasticizer study was required to build good processing and molding properties into the rubber.

Using a base stock (1271-18) as control, we added 5 phr of various plasticizers and noted the degree of improvement in flow characteristics. The test method involved placing a 10-gram biscuit between parallel plates, then curing for 5 minutes at 5,000 gauge pressure and 300° F. in the laboratory press. Surface areas were compared. Results are shown in Table III.

TABLE II—HEAT CONDUCTIVITY OF GUMS

Time (min.)	0	3	6	9	12 (end of cycle)
Type of Gum:	Temperature Reached (°F.)				
Smoked Sheet	87	118	148	164	175
SBR (Plioflex 1502)	87	135	170	182	192
NBR (Chemigum N6)	87	140	170	186	193
NBR/Vinyl 70/30 (Hycar 1203)	87	124	158	176	186
Neoprene (Type WRT)	87	134	160	176	186
Chlorobutyl	87	125	150	166	178
Polyurethane (Genthane S)	87	96	124	142	153



Base Recipe		Fillers	
Smoked Sheet	100.0g	1. Zinc Oxide	120.0g
Stearic Acid	1.0	2. Dixie Clay	120.0g
Agerite Powder	1.0	3. Dixie Clay	150.0g
Zinc Oxide	5.0	4. Kalvan	140.0g
Iron Oxide	4.0		
P-33 Black	1.0		
Sulfur	2.76		
MBT	1.76		
Methyl Tuads	0.5		
Filler	XX		

FIG. 3—Thermal conductivity of the base recipe tested with three different fillers.

Table IV shows a similar plasticizer study, conducted on SBR soling stock after acquisition of a Mooney plastometer. A third test series on nitrile soling stock is reported in Table V.

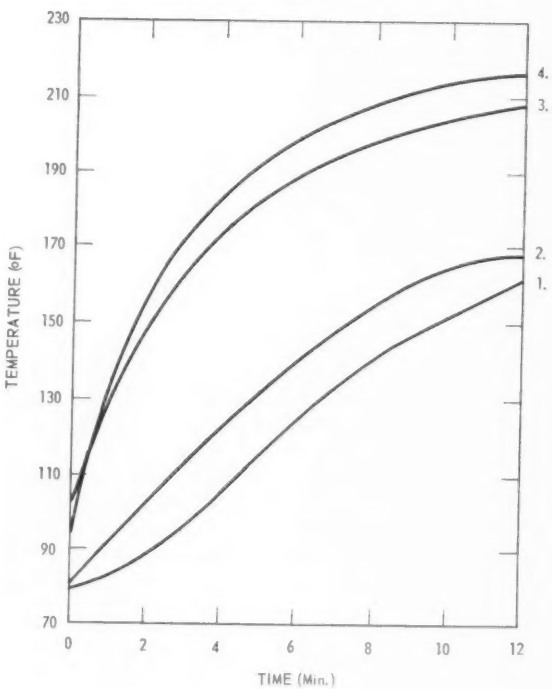
Another method commonly used to improve processing, calendering and handling of compounded rubber involves the use of reclaim rubber. Since the variety of non-filled reclaims available is rather limited, availability of desirable grades presented a problem. There appears to be an ample supply of black reclaim, a limited amount of red, but practically no white or neutral reclaim.

Good quality reclaim is less expensive than the better grades of natural rubber. A limited amount —usually 25 to 30 per cent (based on weight of rubber hydrocarbon)—can be used to produce high-grade soling stock. Including a high percentage of reclaim is a common method for reducing cost. However, stocks containing reclaim rubber show inferior physical properties, particularly as regards abrasion resistance.

In studying a number of the available reclaim rubbers, we found that an appreciable loading was detrimental to durability. We found reclaim proved most advantageous when used in small quantities—up to 5 per cent (by weight) of natural rubber hydrocarbon—in the preparation of non-marking stocks. A loading of 5 per cent of black rubber reclaim containing 18 per cent carbon black gave the necessary tinting power for a non-marking sole.

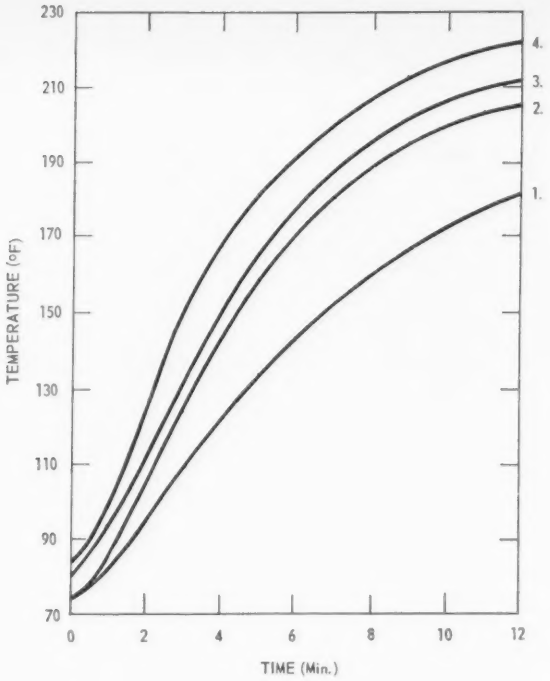
Vulcanized vegetable oils, commonly called "factice", are frequently applied in rubber compounding as a processing aid for high filler loadings. We evaluated a number of these rubber extenders in soling stock compositions and found that factice would have the following effects at small percentage loadings: negligible influence on tensile strength, improve processing, impart tack, and reduce abrasion resistance. The effect of hardness versus six types of factice is shown in Figure 7.

Another method of softening rubber involves peptizing agents. The term "peptize" means to make soluble. Peptizers are organic compounds whose effect on rubber is to create a gel; i.e., nerve breakers. Only a small percentage is required to reduce the



Base Recipe		Fillers	
Smoked Sheet	100.0g	1. None - Base Recipe	
Stearic Acid	1.0	2. Magnesium Carbonate	102.0g
Agerite Powder	1.0	3. Dixie Clay	120.0
Zinc Oxide	5.0	4. Calcium Carbonate	140.0
Iron Oxide	4.0		
P-33 Black	1.0		
Sulfur	2.76		
MBT	1.76		
Methyl Tuads	0.5		
Filler	XX		

FIG. 4—Four more fillers were tried in combination with the same base recipe.



Base Recipe	
Pale Crepe	100.0g
Stearic Acid	1.0
Agerite Powder	1.0
Zinc Oxide	5.0
Iron Oxide	4.0
P-33 Black	1.0
Sulfur	2.76
MBT	1.76
Methyl Tuads	0.5
Filler	XX

Fillers	
1. None - Base Recipe	
2. Silene EF	140.0g
3. Kalvan	140.0g
4. Dixie Clay	150.0g

FIG. 5—Using a pale crepe instead of smoked sheet, three fillers gave results depicted here.

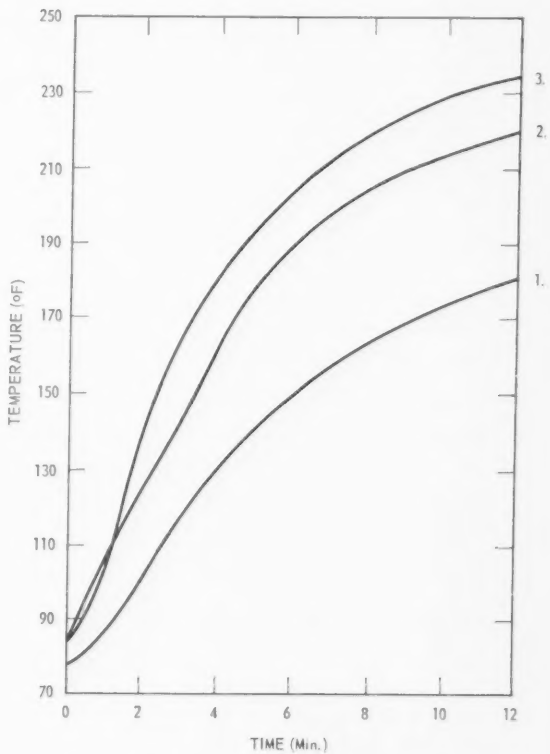
nerve in rubber. The more common peptizers include: phenyl hydrazine, nitroso-beta-napthol, thio acids (thio benzoic), aromatic mercaptans and RPA (zinc chloride and phenyl hydrazine).

Mercaptans were found to be very effective but extremely odoriferous. RPA and phenyl hydrazine are also potent, but smelly and rather toxic. Our study with peptizers was limited, because we found means of bypassing them. For fast rubber processing, such as factory production, the use of peptizers would undoubtedly prove advantageous.

For our particular study, mastication of the rubber on an open mill engendered sufficient breakdown. Initial rubber breakdown is required to reduce rubber nerve, also to convert rubber into the necessary state for proper dispersing of fillers and other additives, as shown in Figure 8.

Our filler study revealed that hardness could not practically be controlled by fillers alone, primarily because of processing difficulties which would arise. We could not establish a range of hardness stocks without detracting from desired physical properties in the final product (Figure 9). Blends of fillers resulted in some flexibility, but a controlling aid such as resins had to be added. High-styrene resin is a copolymer of styrene and butadiene, developed primarily as a reinforcing and processing aid for SBR rubber. Thus, the resin is a copolymer of the same chemical units that comprise the rubber, basically differing only in styrene content. The resin finally selected was Pliolite S-6B (85:15 styrene/butadiene), furnished by Goodyear Chemical Co.

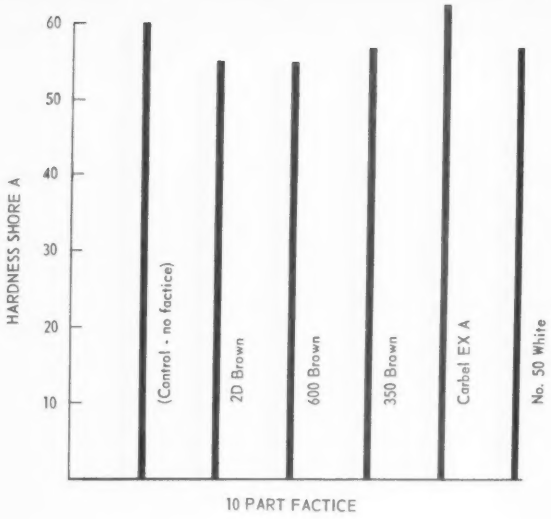
This resin had the following effects on soling stock formulations: increased tear resistance, reduced abrasion resistance, improved flex life, increased stiffness, reduced tensile and elongation, reduced shrinkage in uncured stock, increased hardness and improved processing. Shore A hardness versus resin loading for a typical soling stock is shown in Figure 10. With this thermoplastic resin we were able to obtain suitable hardness ranges in both natural and SBR soling stocks. In NBR soling stocks, phenol-formaldehyde resins proved suitable for hardness control.



Base Recipe	
Smoked Sheet	100.0g
Stearic Acid	1.0
Agerite Powder	1.0
Zinc Oxide	5.0
Iron Oxide	4.0
P-33 Black	1.0
Sulfur	2.76
MBT	1.76
Methyl Tuads	0.5
Filler	XX

Fillers	
1. Dixie Clay	75.0g
2. Zinc Oxide	120.0
3. Zinc Sulfide	120.0

FIG. 6—The fourth conductivity study utilized smoke sheet compounded with three fillers.



Base Recipe (1200-35)

Smoked Sheet (No. 2 grade)	100.0
Reogen	1.0
Zinc Oxide	5.0
Sulfur	2.75
Agerite Powder	1.0
Iron Oxide	3.0
Lamp Black	1.0
Stearic Acid	3.0
Dixie Clay	65.0
Silene EF	25.0
Factice	10.0

FIG. 7—This bar graph shows differential effects of various vulcanized vegetable oils as a processing aid.

From the standpoint of suitable soling stocks for the vulcanized-on-sole process, this study was unquestionably the most important and involved of the entire investigation. The heart of the soling stock problem was: How to prepare stocks that would cure within the prescribed time limits? Many considerations were involved, among them: the sulfur bloom problem, effective curing systems, superaccelerated systems, stock-storage stability and processing methods.

Surface recrystallization of sulfur in its dendridic form was clearly evident on the soles of shoes brought over from Europe. Such surface bloom is very unsightly and detrimental to sales appeal.

A good authority *(4)* in the rubber field notes chemicals that have a tendency to migrate in rubber are those with a low solubility in rubber at ambient temperature, but a high solubility at milling and curing temperatures. Due to complete solution at high temperature, with resultant absence of crystal fragments to serve as nuclei for recrystallization, a supersaturated condition exists. With no internal nuclei to work on, recrystallization shows preference for interfaces, particularly air-liquid or air-solid.

Included in the nonblooming category are a few popular activators and sulfur substitutes: benzothiazyl disulfide (altax), diphenyl guanidine (dpg), mercaptobenzothiazole (captax), meta-toluene-diamine (MTD), tetramethyl thiuram monosulfide (Unads), and tetramethyl thiuram disulfide (Methyl Tuads). These compounds have never been identified as a surface bloom in rubber according to some authorities, but others hold a contrary opinion. We found that an excess of Methyl Tuads, for example, will bloom quite readily when used to replace sulfur in its entirety.

The recommended preventive methods for sulfur surface blooming are: reduce the concentration of the blooming ingredient to the point where it is soluble at room temperature; introduce another ingredient that will increase the solubility of the bloomer; serve as a nuclei for recrystallization; react with excess to reduce concentration; and inhibit surface crystallization.

For the purposes of our investigation, requiring a fast-curing rubber composition cured from a unidirectional heat source, rules laid down by others did not seem to apply. In our intensive efforts at this point, we found: (1) A low concentration of sulfur —below the solubility point at room temperature— would not effect a sufficiently fast rate of cure. (2) High concentration of sulfur—3 to 4 phr— showed bloom tendency in the cured or uncured state. (3) Surface bloom inhibitors coupled with a minimum of selected sulfur appeared satisfactory.

TABLE III—PLASTICIZER STUDY FOR LOW-PRESSURE NATURAL RUBBER SOLE MOLDING STOCKS

(Based on 10 g. biscuit, press-cured at 5,000 gauge, 300° F. for 5 min.; Stock 1271-18 as control, 96 mm dia. disc.)

Plasticizer (5 phr)	Increase in Flow (%)
Pine Tar	24
Roxtone	9
Picco 75	15
Piccolastic D-75	6
Depolymerized Nat. Rubber	13
Piccolastic A-25	7
Neville LX 685	6
Piccolyte S-100	15
Piccopale 100	15
Carbowax 4000	6
Ester Gum Wax	6
Piccolastic A-75	6
Carnauba Wax	22
Stabelite Ester 10	17
Synthol	28
Cumar R-28	6
Reogen	12
Circosol 2XH	15
K-90	8
Dioctyl Adipate	16
Stearic Acid	16
Oleic Acid	17
Plastone (Harwick)	35.5
Acra Wax C	0
Santicizer 213	10
Piccopale 70	6
Piccopale 85	6
Piccolyte S-40	6

TABLE IV—MOONEY PLASTICITY STUDY OF SBR SOLING STOCK

Base Recipe

SBR Plioflex 1502 (Goodyear)	100
Pliolite S-6B (high styrene resin)	20
Silene EF	50
Plasticizer	10
Zinc Oxide	5
Stearic Acid	1

Plasticizer	Mooney Viscosity ML (1) plus 4 (212)
Circo Lt. Oil	92
Coray 40 (Esso)	84
Pine Tar	98
Necton 60 (Esso)	92
Dutrex 20 (Shell)	93
Cumar R-29	98
Roxtone 180 (Esso)	84
Califlux 550	95
Nuso 250 (Esso)	95
Arneel T	84
Reogen	84
Adipol ODY	89
Paraplex G 40	110
Plastone	106
Synthol	112
Mineral Oil	90
Oleic Acid	107
Cumar MH 2½	108
Resinex 100	124
Sundex 41	101
Castor Oil AA	87
Pale 4	90
Liquid Hycar 1312	87
Flexresin	82
Polycin	103
Stabelite Ester #10	102
Polymel DX 11	94
Paraflux 2016	93
Plasticizer 4775	81
Polybutene #32	102

Note: Although several of the above plasticizers showed good plastic flow properties, extensive study was restricted to Esso process (Coray and Roxtone) oils, since these are relatively inexpensive.

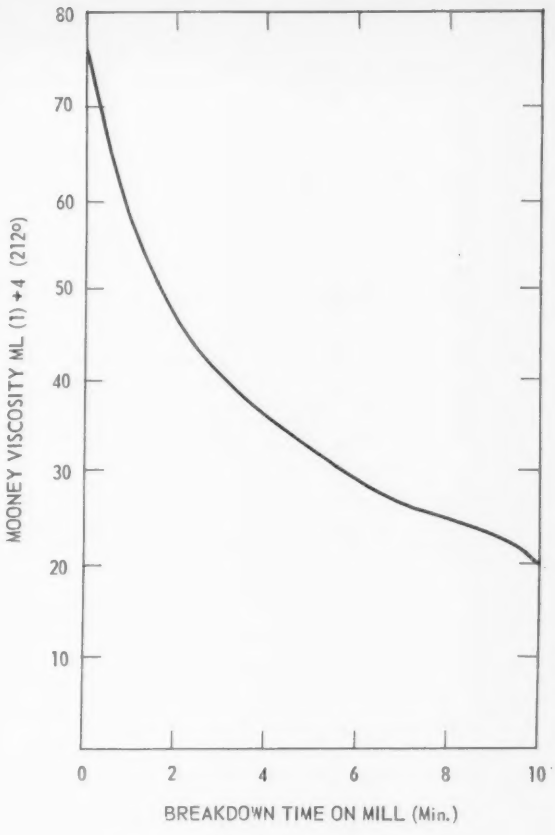


FIG. 8—That preliminary milling is required to reduce rubber "nerve" is shown by this graph.

We determined which of the common types of sulfur showed the least tendency toward bloom (Table VI). Despite the low sulfur concentration, only the Rubbermaker sulfur and sulfur-rubber blend (Ko Blend IS) showed no bloom tendency; however the 2 phr of sulfur were found insufficient for the required fast rate of cure needed (Table VII). A minimum of 2.5 parts free sulfur were needed to effect an adequate cure. The KO Blend IS, with 40 per cent available sulfur freely dispersed in an SBR rubber, showed good physical properties. Therefore, it was used in a soling stock formulation.

Control of sulfur migration caused an exhaustive search for a satisfactory activator system. Rubber activators or accelerators, in order of activation (*5*), are shown in Table VIII. Our studies were confined primarily to groups No. 2, No. 3, and No. 4. Groups with activation below No. 4 were too slow for the short cure times. Xanthates were not studied extensively.

TABLE V—MOONEY PLASTICITY STUDY OF NITRILE SOLING STOCK

Base Recipe

Chemigum N-6	100
Silene EF	55
HiSil 233	20
Zinc Oxide	5
Stearic Acid	1
Pliolite S-6B	15
Paraffin	3
Plasticizer	20

Plasticizer (phr)		Mooney ML (1) plus 4 (212)
Cumar R-29	(10)	59
DBP	(10)	
Bondogen	(3)	48
Arneel SD	(7)	
Cumar R-29	(10)	
Adipol ODY	(20)	52
Arneel SD	(20)	54
KP-140	(10)	70
Cumar R-29	(10)	
Paraplex G62	(5)	61
Arneel SD	(5)	
Cumar R-29	(10)	

TABLE VI—TYPE SULFUR VS. SULFUR SURFACE BLOOM

(Based on 100 parts rubber)

Compound: Sulfur	No. 1	No. 2	No. 3	No. 4	No. 5
Hanover	2	—	—	—	—
Rubbermaker	—	2	—	—	—
Flower	—	—	2	—	—
Spider	—	—	—	2	—
KO Blend IS (40% available sulfur)	—	—	—	—	5.0
Captax	1.0	1.0	1.0	1.0	—
Altax	1.0	1.0	1.0	1.0	—
MeTuads	.5	.5	.5	.5	—
DPG	—	—	—	—	1.5
Sulfur Bloom (cured stock)	yes	no	yes	yes	no

TABLE VII—SULFUR AND ACCELERATION VS. DEGREE OF CURE

(Based on 100 parts rubber)

Compound	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
Sulfur	2.5	2.5	2.0	2.0	2.0	—	2.5
Captax	1.0	1.0	—	—	—	.5	—
Altax	1.0	1.0	—	—	—	—	—
MeTuads	.5	.5	.6	—	—	—	.5
Aero Xanthate	—	—	—	.4	.6	—	—
KO Blend IS	—	—	—	—	—	4.0	—
Santocure	—	—	—	—	—	—	2.0
Paraffin	2.0	—	—	—	—	—	—
Degree of Cure for 9 mm Slab (%)	80	80	60	50	50	95	80

One of our most important series of accelerator studies, which included sulfur-less cures, led to four curing systems that withstood blooming for several months. Our final natural rubber soling stock formulations were built around No. 4, No. 7, and No. 11, shown in Table IX.

Having determined satisfactory cure rates and bloom control, two obstacles remained: scorch rate and stability at ambient temperature.

The simplest method for determining the shelf-life of a soling stock at room temperature is to expose the soling material to it, determining the moldability of the stock under vulcanizing conditions daily. When the soling material fails to form a perfectly molded sole, it has reached the precured state. A slight precure can be eliminated by refining the material on a rubber mill with reclaiming chemicals.

Our selected soling stocks ranged in storage stability (shelf life) from 3 to 17 days, the former being an 8 to 10 minute curing stock and the latter a 12 to 14 minute curing stock. Refrigerated, fast-curing soling material will not precure, and can be stored indefinitely. We found one of our soling materials showing evidence of precure in 3 days at room temperature (average 75° F.), perfectly usable after 8 months at 0° F.

For every vulcanizable rubber compound, there is an optimum curing condition, the time-temperature cycle that will bring out the very best physical properties. The optimum cure is most readily determined by plotting tensile strength vs. cure time, but it can be calculated by other methods. Proper cure is re-

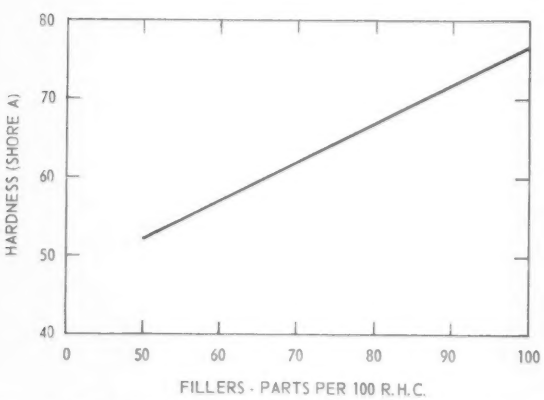


FIG. 9—This straight-line relationship refers to effect of filler concentration on hardness of 1296-38-2 rubber stock.

TABLE VIII—RUBBER ACCELERATORS IN ORDER OF ACTIVATION

Group	Softening	Modulus	Tensile
Xanthates	no	high	high
Dithiocarbamates	no	high	high
Thiuram Sulfides	no	high	high
Mercaptobenzothiazole	yes	low	low
P-nitroso Dimethyl Analine	yes	low	low
Vulcanol	no	high	high
Aldehyde Amines	yes	high	high
Ethylidene Aniline	yes	low	low
Aldehyde Ammonia	no	low	low
Guanidines	no	high	high
Hexamethyline Tetramine	no	high	high

TABLE IX—CURING SYSTEMS FOR NATURAL RUBBER SOLING STOCK*

Compound:	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14
Sulfur	2.5	1.8	2.5	2.5	2.5	2.0	2.0	2.0	1.8	—	—	—	1.5	2.0
DPG	.4	—	—	—	—	—	—	—	—	—	1.5	—	—	—
Captax	.3	—	.3	1.0	1.0	1.0	1.0	1.0	—	1.0	.5	—	1.0	1.0
MeTuads	—	.4	—	.5	.5	.5	.5	.5	—	—	—	—	.5	.5
DOPG	—	—	.4	—	—	—	—	—	—	—	—	—	—	—
Altax	—	—	—	1.0	—	1.0	1.0	1.0	—	—	—	—	1.0	1.0
Dipac	—	—	—	—	1.0	—	—	—	—	—	—	—	—	—
Hexa	—	—	—	—	—	—	—	2.0	—	—	—	—	—	—
Unads	—	—	—	—	—	—	—	—	.4	—	—	.3	—	—
MeSelenac	—	—	—	—	—	—	—	—	—	4.0	—	—	—	—
KO Blend IS	—	—	—	—	—	—	—	—	—	—	3.0	6.0	—	—
Santocure	—	—	—	—	—	—	—	—	—	—	—	1.5	—	—
Sulfasan R	—	—	—	—	—	—	—	—	—	—	—	—	3.0	—
Paraffin**	—	—	—	1.0	—	—	—	—	—	—	—	—	—	—

* Compounds 2, 4, 7 & 11 show no surface bloom after 2 months. Only 4 and 11 acceptable for cure rate. ** Used as surface bloom inhibitor.

flected by the abrasion index, especially relevant to wear quality. In brief, properly cured rubber wears better than overcured or undercured rubber.

This rule was proved by curing a block of rubber in a method simulating the BUSMC vulcanizer with an unidirectional heat source. The cured rubber, ½ inch thick, was stratified into three equal layers, then abrasion resistance tests were run on the six surfaces, as reported in Figure 11.

Those surfaces closest to 350° F. showed overcure and greatest wear. The surface in the vicinity of the optimum cure temperature of 300° F. showed the least amount of wear. Surface No. 6 was gummy, indicating undercure. Temperature of the respective layers was determined at the end of the cure cycle with a multiwire thermocouple.

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(5) Barrow, H., *Modern Rubber Chemistry*, 2nd Edition, Hutchinson's Technical, London, England (1947).

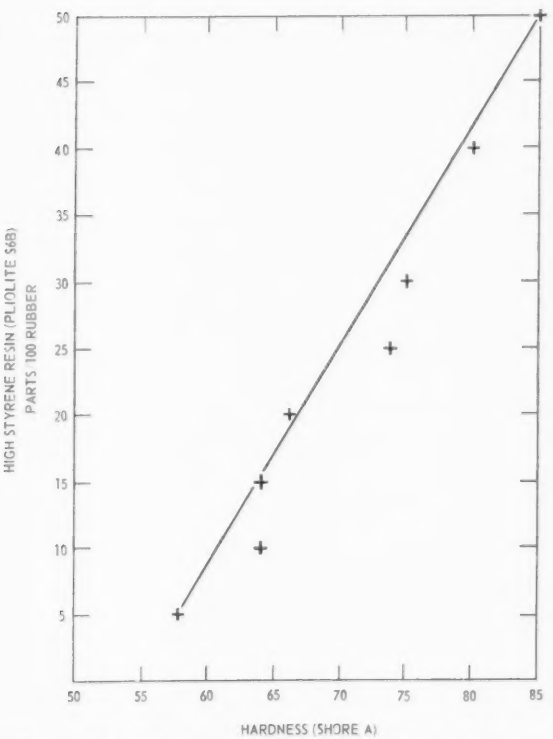

FIG. 10—Higher hardness could be achieved only at greater resin loadings, as shown here.

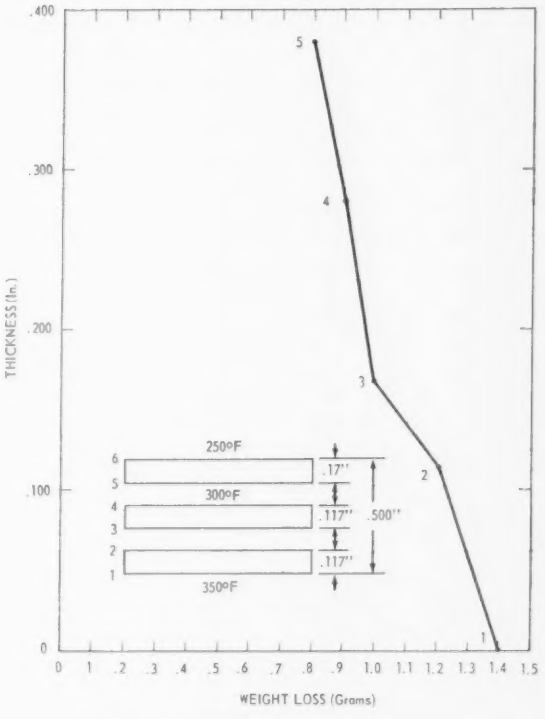

FIG. 11—Results of stratified abrasion resistance tests are depicted for a six-surface stock.

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THE general capabilities of the vinylidene fluoride-hexafluoropropylene copolymer Fluorel brand elastomer in resisting the deteriorating effects of heat, cold, chemical, and mechanical forces have been previously described *(1)*. In formulating to achieve the optimum in such properties or to qualify under specifications designed for specific areas of end-use, data which show the effect of variations in cure content become helpful if they comprehend the range up to failure, or near failure. Thus a balance of heat resistance and compression set can be estimated; and certain properties, such as tensile strength, elongation, and hardness can be predicted to a degree that is useful in correlating performance at any interval of time and temperature.

The properties of Fluorel Elastomer raw gum are shown in Table I. Table II shows five compounds aimed at meeting the specification MIL-R-25897A Rubber, High Temperature, Fluid Resistant. These compounds contain a small amount of medium thermal carbon black to smooth processing and an appropriate magnesium oxide to assure a high state of heat resistance in conjunction with the two curing agents, HMDA-C (hexamethylene diamine carbamate) and Copper Inhibitor No. 65 (active ingredient disalicylal propylenediamine). Increasing amounts of carbamate are used from A to E. Variations in Copper Inhibitor No. 65 are used to obtain other combinations of original and aged properties that better conform to the requirements of the specification; molding is also improved, and, in some processes, more safety against scorch is obtained. As total cure content is increased, tensiles remain similar while elongations decrease progressively and hardness increases slightly. For most formulations within the range shown, the carbamate contributes to relatively higher elongations and lower hardness, and the Copper Inhibitor No. 65 to relatively higher tensiles during air aging.

The original properties of all compounds are above the specification minimums. Upon aging in a circulating air oven, most properties held within the allowable percentage losses. Compound A, although having good original tensile, consistently fails to hold within the 35 per cent allowable loss. With increasing cure content, tensile requirements are more easily met, and elongation retention becomes more marginal. Compression sets meet the requirements, becoming better with increased cure. Upon aging for 72 hours at 400°F. in the hydraulic fluid MIL-O-8200 and in the diester lubricant MIL-L-7808 (Anderol L-774),

TABLE I—TYPICAL RAW GUM PROPERTIES

Specific Gravity	1.85
Fluorine by weight, %	>60
Color	Off-white
Shore A hardness	40
Mooney viscosity ML-4/212°F.	135
Embrittlement temperature, °F.	—50
Low temperature stiffness (ASTM D-1053-52T)	
Gehman T_2, °F.	+15
T_5	+ 5
T_{10}	+ 2
Storage stability	Excellent
Solubility	Esters and Ketones

all except Compound D in MIL-L-7808 retained the required minimums. After 72 hours at room temperature in Ref. Fuel B, Compound C meets requirements while Compounds B and D were found to be slightly outside the allowable tensile loss. The per cent tensile changes have ranged from 0 to —14 per cent for Compounds B, C, and D, and —15 to —20 per cent for Compounds A and E with other batches of these compounds. Experience has shown that control compounds vary by approximately 10 per cent on original properties, indicating essentially no change for most of these fluid-aged compounds.

Figures 1, 2, and 3 show the effect upon tensile strength, elongation, and hardness of oven aging at 450°F. for 30 and 45 days. All compounds show similar small losses in tensile (Figure 1). As total cure is increased, there is a significant reduction in ultimate elongation (Figure 2). Compound A has an ultimate elongation of 250 per cent after 45 days; Compound B has 140 per cent, while Compound C D, and E have reached the 100 per cent level. Extrapolation of the elongation curves of Figure 2 to 60 days and examination of the hardness curves of Figure 3 would indicate that Compound A retains a substantial margin of safety against embrittlement upon further aging.

Figures 4, 5, and 6 show aging effects at 500°F. for 20 days. Tensile strengths remain high with a tendency for Compound A to be lower and show a higher percentage loss than the other compounds (Figure 4). Elongation and hardness curves (Figures 5 and 6) show significantly less tendency toward embrittlement for Compound A.

Figures 7, 8, and 9 show a pattern of aging effects at 550°F. similar to 450°F. and 500°F. Tensile strengths (Figure 7) were more erratic, and hardness (Figure 9) fluctuated more. The elongation curves (Figure 8) show uniform losses.

Figures 10, 11, and 12 show the effects upon aging at 600°F. for as long as 32 hours. These curves

TABLE II—COMPOUNDS AIMED AT MEETING MIL-R-25897A-RUBBER HIGH TEMPERATURE, FLUID RESISTANT

		A	B	C	D	E
Fluorel elastomer		100	100	100	100	100
Thermax		15	15	15	15	15
Maglite K		20	20	20	20	20
HMDA-C		1	1.2	1.4	1.4	1.5
Copper inhibitor No. 65			0.4	0.2	0.5	
Press Cure: 30 min./300°F. Oven Post-Cure: 24 hrs./400°F.						
Mooney Scorch at 250°F.						
Minutes to 10 Point Rise						
Tested 1 day after mixing		9	9	9	9	7
Tested 14 days after mixing		7	8	8	8	7
Original Properties	Specification					
Tensile strength, psi	1800 min.	2400	2100	2340	2300	2060
Elongation, %	175 min.	310	230	225	205	180
Hardness, Shore A	70±5	68	69	71	72	71
Air Aged 16 hrs./600°F.						
Tensile strength, % change	—35 max.	—44	—25	—27	—22	—25
Elongation, % change	—50 max.	—14	—35	—47	—53	—36
Hardness, change	+15 max.	+ 2	+11	+11	+ 8	+10
Weight loss, %	10 max.	— 4.2	— 4.5	— 5.7	— 6.4	— 5.3
Compression Set, %, 70 hrs./250°F.	25 max.	18	11	9	8	9
Aged 72 hrs./400°F. MIL-0-8200						
Tensile strength, % change	—20 max.	—15	— 4	— 9	—12	—17
Elongation, % change	—25 max.	—19	—17	—20	—15	—19
Hardness, change	±5	— 3	— 2	— 3	— 1	— 2
Volume change, %	1 to 10	2	3	3	2	3
Aged 72 hrs./400°F. in Anderol L-774						
Tensile strength, % change	—25 max.	—19	— 7	—13	—27	—19
Elongation, % change	—10 max.	+ 4	+ 2	— 4	—17	+ 6
Hardness, change	±10	—10	— 9	— 9	— 9	— 9
Volume change, %	1 to 15	14	12	12	12	14
Aged 72 hrs./77°F. Ref. Fuel B						
Tensile strength, % change	—10 max.	—20	—14	— 8	—13	—15
Elongation, % change	—10 max.	— 3	— 3	+ 8	— 3	+ 6
Hardness, change	±5	0	0	0	0	0
Volume change, %	0 to 5	0	2	3	2	2

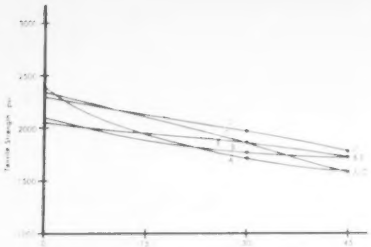


Fig. 1—Effect upon Tensile Strength

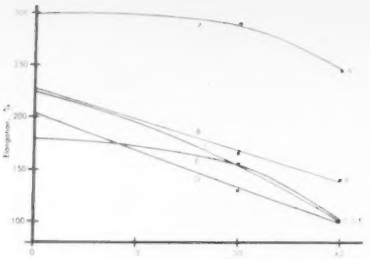


Fig. 2—Effect upon Elongation

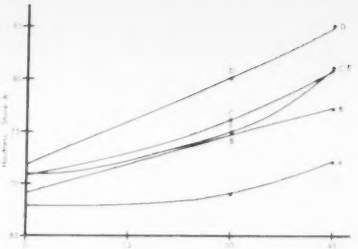


Fig. 3—Effect upon Hardness

Aging Compounds of Table II at 450°F.

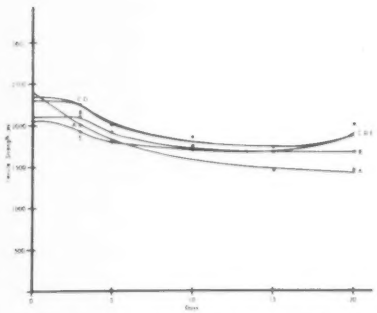


Fig. 4—Effect upon Tensile Strength

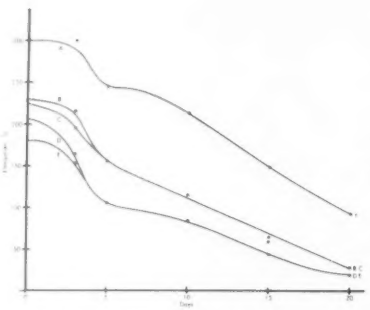


Fig. 5—Effect upon Elongation

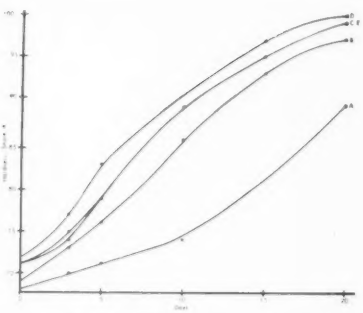


Fig. 6—Effect upon Hardness

Aging Compounds of Table II at 500°F.

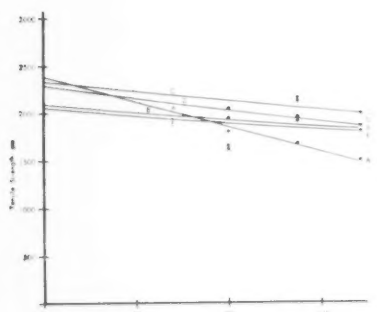


Fig. 7—Effect upon Tensile Strength

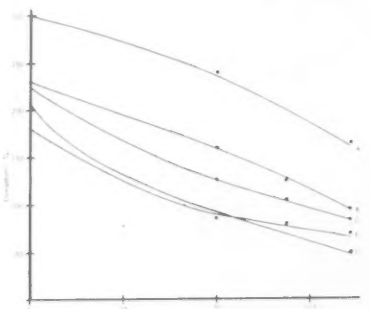


Fig. 8—Effect upon Elongation

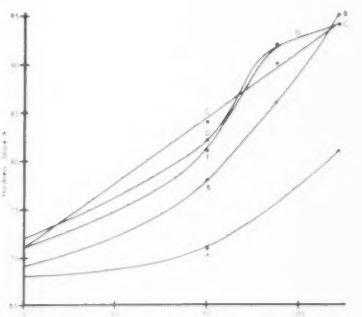


Fig. 9—Effect upon Hardness

Aging Compounds of Table II at 550°F.

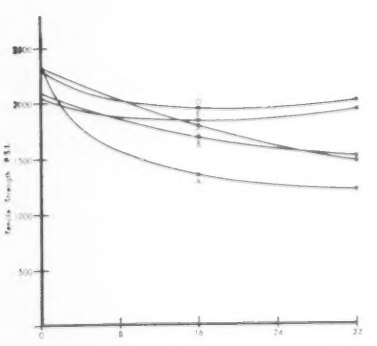


Fig. 10—Effect upon Tensile Strength

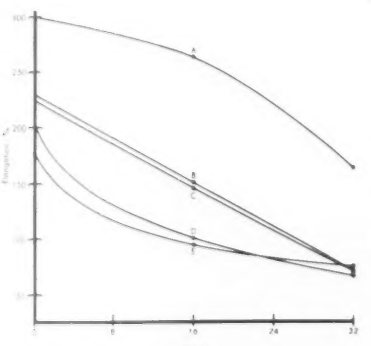


Fig. 11—Effect upon Elongation

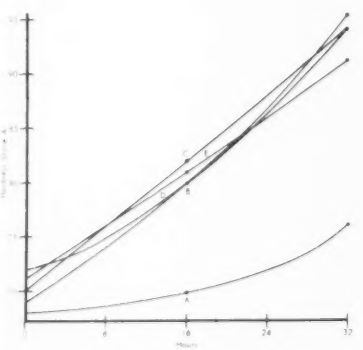


Fig. 12—Effect upon Hardness

Aging Compounds of Table II at 600°F.

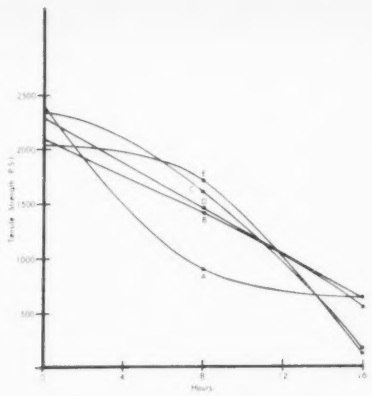


Fig. 13—Effect upon Tensile Strength

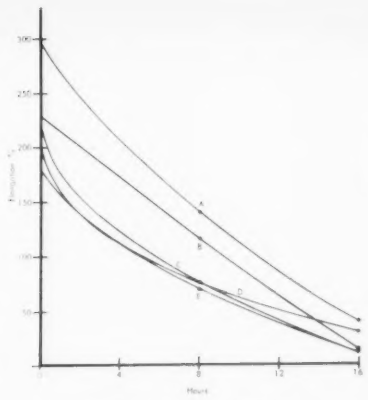


Fig. 14—Effect upon Elongation

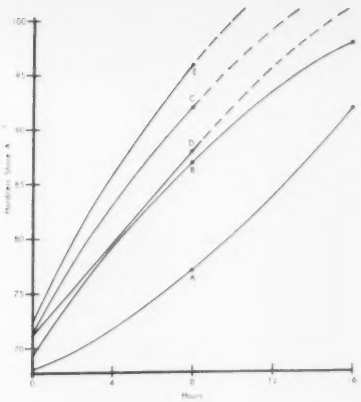


Fig. 15—Effect upon Hardness

Aging Compounds of Table II at 650°F.

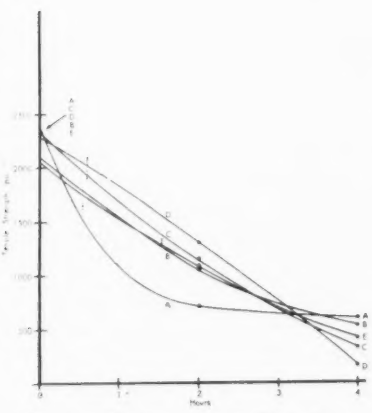


Fig. 16—Effect upon Tensile Strength

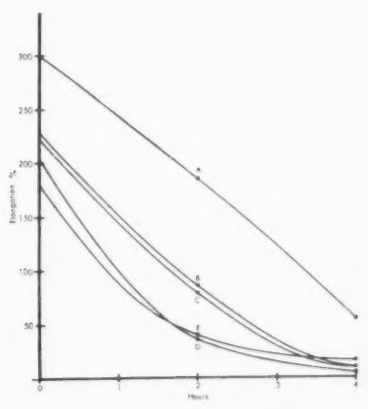


Fig. 17—Effect upon Elongation

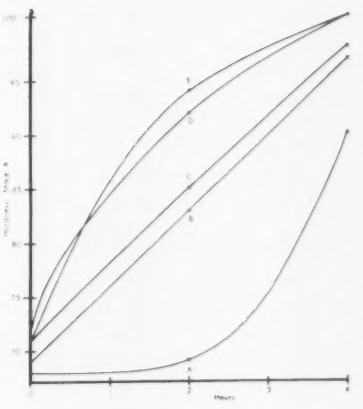


Fig. 18—Effect upon Hardness

Aging Compounds of Table II at 700°F.

illustrate the benefit of added curative in maintaining percentage losses in tensile strength which conform to the MIL-R-25897A specification.

Figures 13, 14, and 15 illustrate aging effects at 650°F. for a maximum of 16 hours, and Figures 16, 17, and 18 at 700°F. for a maximum of 4 hours.

Figures 16, 17 and 18 show the changes taking place in tensile strength, elongation, and hardness after 16 hours as the temperature is increased from 600° to 650°F. These curves indicate that good oven control in this temperature range is needed to assure representative data.

TABLE III—180° BEND DATA ON OVEN-AGED SAMPLES

	A	B	C	D	E
4 hours/700°F.			All Failed		
8 hours/650°F.	Passed	Passed	Passed	Failed	Failed
16 hours/650°F.			All Failed		
32 hours/600°F.	Passed	Failed	Failed	Failed	Failed
5 days/550°F.	Passed	Passed	Passed	Failed	Failed
20 days/500°F.	Passed	Failed	Failed	Failed	Failed

Samples at all other aging conditions passed.

TABLE IV—PER CENT COMPRESSION SET*
(ASTM METHOD B)

Time (Hours)	Temperature (°F.)	A	B	C	D	E
70	250	18	11	9	8	9
70	350	30	29	30	29	31
70	400	42	49	47	46	39
70	450	85	86			
22	450	52	59	61	66	57
22	450**	32	33	33	34	33

* Measured on ½ x 1.129" diameter cylinders, press cured 30 min./300°F. and post-cured 24 hrs./400°F. unless otherwise noted.
** Given extra post-cure of 8 hrs./500°F. before compressing.

Figure 19 illustrates how these oven aging data can be utilized in predicting the time required to obtain a desired value of tensile strength, elongation, or hardness after aging at any temperature in the 450° to 700°F. range. The time required at each temperature to reduce the elongation to a value of 100 per cent is plotted for Compounds A and B. Thus, for Compound A, approximately 460 hours at 500°F., 140 hours at 550°F., 40 hours at 600°F., 11.5 hours at 650°F., and 3.5 hours at 700°F. are required to reduce elongation to 100 per cent. For Compound B, 280 hours at 500°F., 115 hours at 550°F., 26 hours at 600°F., 9 hours at 650°F., and 1.75 hours at 700°F. are required.

Table III shows results of the 180° bend test for air-aged samples, and Table IV shows compression set properties. Higher cure content improved resistance to compression set at 250°F., yet seemed to have little effect at 350°F. and above. A substantial improvement in compression set at 450°F. can be obtained by subjecting the samples to an extra oven post-cure of 8 hours at 500°F.

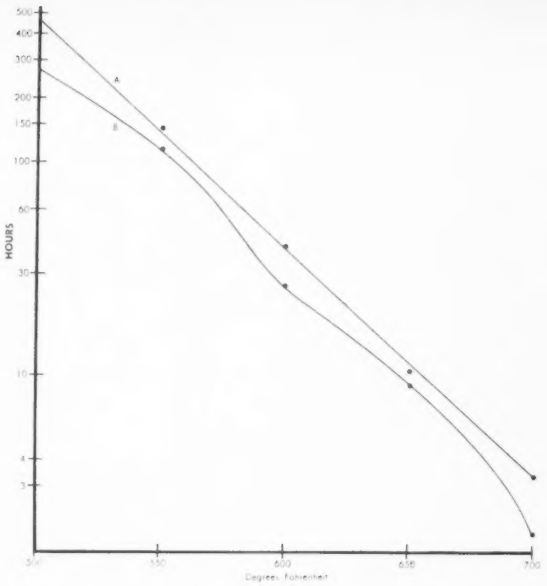


Fig. 19—Time versus Temperature to 100 per cent Elongation for Compounds A and B.

LITERATURE REFERENCE

(1) Stivers, D. A., Honn, F. J., and Robb, L. E., "A Fluid Resistant Fluorocarbon Elastomer for High Temperature Operation," *Ind. Eng. Chem.*, Dec., 1959.

Ford Uses Polysulfide Rubber Molds

Polysulfide rubber compounds are relied on to solve problems in many industries. In the Styling Center of the Ford Motor Company, for example, the compounds have been used for more than a decade.

Mold-making is the original application of the compounds at the Styling Center shops and studios in Dearborn, Michigan. Today this is still their chief use, but Ford stylists and engineers take advantage of the compounds' unique properties to develop important innovations.

An important advantage of polysulfide rubber is the degree of control the user has over the quality of the final mold. The molds can be made hard, soft or medium by regulating proportions of polysulfide and catalyst in the mix and by adjusting cure time.

In its mold-making operations, the Ford Styling Center uses FMC 201, a polysulfide rubber material formulated by Smooth-On Manufacturing Company, Jersey City. This material is poured over a clay model and allowed to set, generally for about four hours. After the polysulfide has set, a plaster cast is built to maintain the shape of the mold, and the mold is covered with a parting agent to prevent sticking. An epoxy resin surface coat then is applied and allowed to set for an hour.

The final step in the fabricating shop is lamination of the fiberglas part to be taken from the polysulfide mold. This involves the application of a fiberglas cloth cover with laminating resin. After setting for several hours, the formed fiberglas is removed for use on a clay, plaster or fiberglas car model in the styling studio. It frequently is plated so that it looks exactly like a production component in metal.

Perhaps the greatest advantage of polysulfide rubber compounds, according to Ford styling fabricators, is the fact that they can be reproduced exactly as the original clay component was modeled. They are far preferable to plaster in this respect.

Engineering Factors in Coating with

SILICONE RUBBER...

for High Temperatures

By H. I. SILVERSHER and FRED OLSTER
Western Backing Corp., Culver City, Calif.

THE COATING of glass cloth with silicone rubber is rapidly gaining impetus as an important contribution to high-temperature technology. The combination provides a material that has excellent flexibility and strength over a wide temperature range.

The function of the glass is to impart a high degree of mechanical strength and tear resistance to the product, while the silicone rubber has excellent flexibility, resiliency, dielectric strength, high and low-temperature resistance, and moisture protection. Another noteworthy feature of the rubber is its exceptional ability to withstand ozone and corona attack.

Selection of the proper silicone rubber compound is very important. The fabricated part dictates component requirements. General aspects to be considered in choice of a compound are: outstanding heat resistance; excellent layer-to-layer bond; good compression set, and a high degree of flame retardancy. The coater also looks for good application characteristics. This includes good cloth penetration, adhesion of the rubber to the glass cloth, building tack and uniform curing.

The cloth most widely employed with silicone rubber is glass cloth. Its desirable attributes are high strength, temperature and moisture resistance. Special finishing operations are necessary, because natural woven glass cloth contains as much as 6 per cent sizing. This sizing is usually an oil-starch combination which decomposes at the curing temperatures used with silicone rubbers. The decomposed film forms a layer between the cloth and the rubber capable of causing a defective bond and increased moisture pickup.

The two most used cloths are: (1) Carmelized Cloth—glass that has been heat treated to reduce its sizing content to about ½ per cent. Its commercial designation is "Finish 111." This treatment produces a cloth that is excellent for mechanical application; however, the presence of any amount of retained sizing influences moisture absorption detrimentally for electrical applications;

(2) Desized Cloth—glass cloth heated to a point whereby all of the sizing is removed. This procedure does not yield a cloth having as high a degree of physical strength as does the process for carmelized cloth, but produces better fabric for electrical applications. It is commercially designed as "Finish 112."

Using Glass Cloth

Both carmelized and desized cloth can be produced in the coating plant prior to application of the silicone rubber. To carmelize, the cloth should be heated to a temperature of about 500° F. for 20 to 30 minutes. To completely desize, it is heated to 650° F. for a period of 4 to 24 hours, depending on the thickness of the fabric being desized. The temperature should not exceed 800° F. if maximum physical properties of the cloth are to be maintained. Metal cones and rolls are used in the desizing operations, for the temperatures employed would decompose parts made from organic materials.

Asbestos cloth is also sometimes used in combination with silicone rubber. Organic reinforcing threads present in "standard" cloth can be removed from the fabric by an oven treatment of 500° to 600° F. for

3 to 4 hours. Asbestos cloth with 100 per cent inorganic paper, or asbestos cloth reinforced with glass fiber can be utilized without the oven-bake preparation.

In addition to glass and asbestos cloth, other organic fabrics are often coated with silicone rubber. Cotton, dacron, nylon, orlon, silk, acetate and mylar have been used. Each of these poses an individual problem. The temperatures used in coating these materials must be lower than those for coating glass fabrics. This necessitates adjustments in silicone formulation in order to obtain the proper curing cycles.

Unprocessed silicone rubber usually comes in the form of solid blocks or extruded strips. To utilize the material for coating, it must be solvated to the proper viscosity and catalyzed to conform with the required time/temperature curing cycle. In order to facilitate solution, the material should be processed on a rubber mill to form thin sheets. This breaks down residual "nerve" and exposes more of the surface to the solvent.

Most Effective Solvents

The most effective solvents for silicone rubber are non-polar, having a high Kauri-Butanol number. Toluene, xylene and petroleum spirits are the most commonly used. It is desirable for the solvent to leave a minimum of residual matter. Certain additives, such as antioxidants and rust inhibitors, that interfere with the cure of the silicone should be avoided.

In processing the compound, the solvent should be put into a suitable mixer, and the sheeted silicone rubber added while the mix is agitating. Agitation should be continued until a smooth, homogeneous mixture results. Mixers that build up heat or electrostatic charges should not be used. Heat during solvation can have a detrimental effect on the peroxide catalyst. Electrostatic charges present an explosion hazard.

Equipment should be grounded, with mixer temperature not exceeding 105° F. Explosion proof equipment must be used, ventilation should be adequate, and all sources of flames or sparks eliminated.

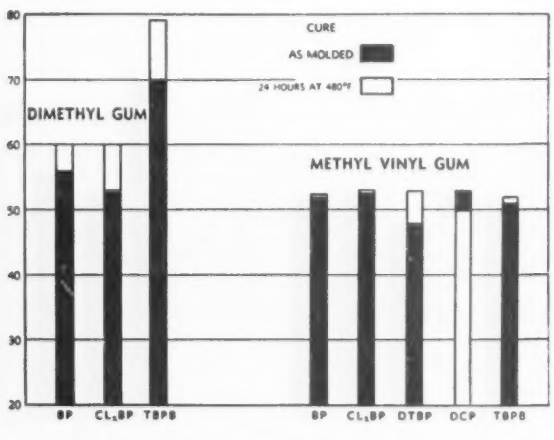


FIG. 1—Effect of curing conditions on durometer hardness, using the amount of peroxide to give maximum tensile strength.

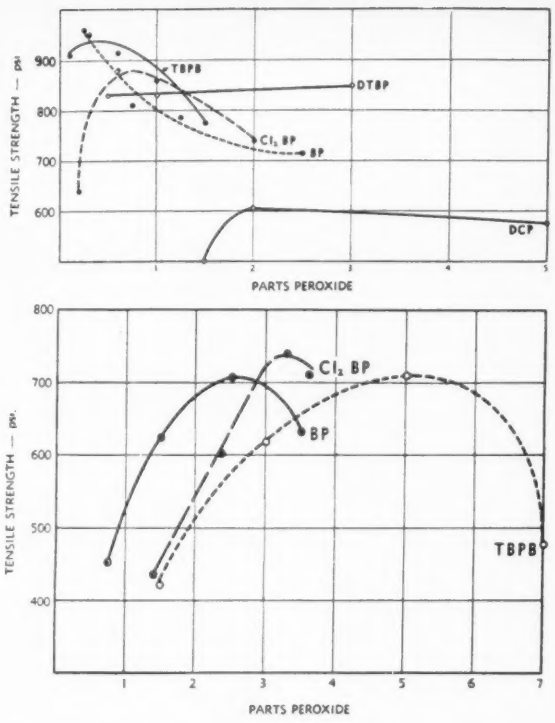


FIG. 2—Effect of type of peroxide on tensile strength. Upper graph for methyl vinyl gum; lower graph for dimethyl gum; both polymer compounds cured 24 hours at 485°F.

Another important step in preparing silicone rubber for coating is the addition of a catalyst. Proper choice of catalyst is a function of the requirements of the end product, as well as of the curing method employed. For dimethyl and methyl vinyl polymers, the most common vulcanizing agents are benzoyl peroxide; 2, 4 dichlorobenzoyl peroxide, tertiary butyl perbenzoate, ditertiary butyl peroxide, and dicumyl peroxide.

Postcure Affects Hardness

Hardness of the silicone rubber is sometimes a factor, too. If a methyl vinyl polymer is used, benzoyl peroxide, dichlorobenzoyl peroxide, and tertiary butyl perbenzoate give the highest durometer readings. With dimethyl polymers, tertiary butyl perbenzoate leads to the highest durometer hardness. Length of time and temperature of the postcure affect the final hardness of the dimethyl polymers more than the methyl vinyl polymer (Figure 1).

Maximum tensile strength of methyl vinyl polymers is developed with lower amounts of catalyst. In dimethyl polymers, maximum tensile strength is obtained with higher amounts of catalyst. In both cases, excess catalyst will cause a decline in tensile strength (Figures 2 and 3).

When methyl vinyl polymers are employed, less reactive catalysts—ditertiary butyl perbenzoate and dicumyl peroxide—give the highest elongations, changing less with increasing amounts of catalyst. Raising peroxide content of dimethyl polymers causes a decline in elongation (Figures 4 and 5). Increased oven cure produces a greater drop in elongation with dimethyl polymers (Figure 6).

Low compression-set values are obtained with methyl vinyl polymers. In order to reach good compression set values with the dimethyl polymers, additives such as mercuric oxide are necessary, but toxicity discourages the use of such a system. When minimum amounts of peroxide are used, compression set values are similar for all curing agents. With increasing amounts of peroxides, the upper extreme is attained with benzoyl peroxide, the lower with ditertiary butyl perbenzoate. Compression set values of dimethyl polymers start higher than those of methyl vinyl polymers (Figure 7).

Increasing Peroxide

Increasing amounts of peroxide produce a rapid decline in tear strength of both polymers. Ditertiary butyl perbenzoate shows the least decline (Figure 8).

The three factors affecting the shrinkage of silicone rubber after vulcanization — aside from fillers and loading—are the amount of material lost in the form of volatiles, the coefficient of thermal expansion of the silicone rubber, and the type of polymer used. Shrinkage is more directly related to curing temperature than to the catalyst used. Heating the silicone rubber to curing temperature produces thermal expansion and cure takes place in this expanded condition. Upon cooling to room temperature, the cured material shrinks to dimensions smaller than those of the original uncured material. Additional shrinkage is produced through loss of volatile material, but this is not a function of the amount of peroxide employed (Figure 9).

Step oven-cures are usually recommended. If a final 480° F. cure is employed directly, blowing and discoloration ruin the final product. For methyl vinyl polymers, the best catalysts are ditertiary butyl peroxide and dicumyl peroxide. These can be used with a direct curing temperature of 480° F., and form an exception to the general rule of step curing applicable to other catalysts. Small amounts of dichlorobenzoyl peroxide can also be employed with direct curing temperature. However, in this case, hardness is not uniform and there is slight discoloration.

A vertical tower is ideal for coating fabric from a low-viscosity silicone rubber solution. Multiple heating zones, with the temperature of each zone controlled separately, is ideal for this operation.

The initial zone of the tower removes all solvent from the coated cloth and activates the curing agent used with the rubber. It is important that this zone have means of keeping the solvent concentration well below the explosive limit. Two methods of assuring this are by moving fresh air and by catalytic burning. The latter method is preferable because it removes odor and toxic materials in the air being discharged from the plant. Lira units work in conjunction with catalytic burners, preventing explosive concentrations from forming.

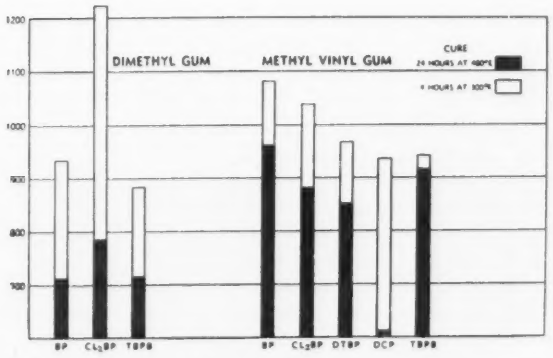


FIG. 3—Tensile strengths of dimethyl and methyl vinyl gum compounds at various cures, using the amount of peroxide to give maximum tensile.

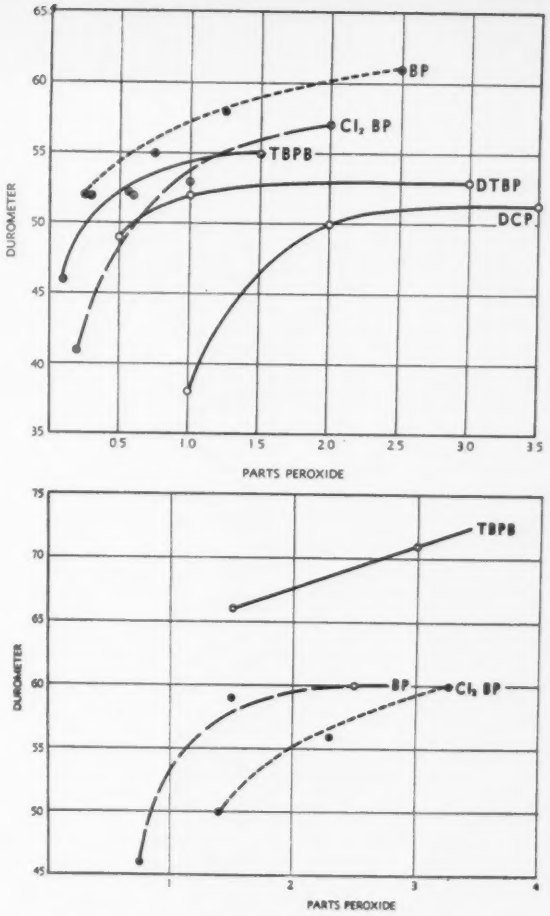


FIG. 4—Effect of type of peroxide on durometer hardness. Upper graph for methyl vinyl gum; lower graph for dimethyl gum; both polymer compounds cured 24 hours at 480° F.

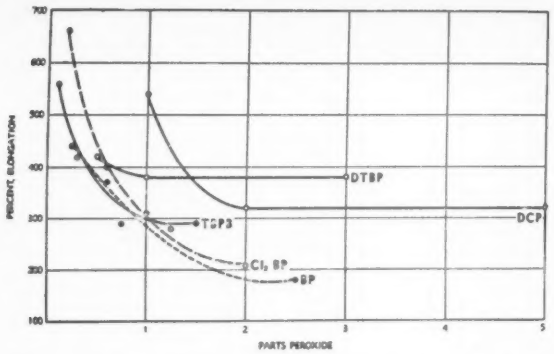


FIG. 5—Effect of type of peroxide on elongation at break for methyl vinyl gum stocks cured 24 hours at a temperature of 480°F.

The temperature in the first zone is critical and must be closely controlled in order that desired physical and chemical properties are obtained. If the temperature is too high, the coating can blister from too rapid removal of solvents. Pinholes are formed from a too rapid breakdown of the curing agent. If there are several passes in the first temperature zone, solvent evaporation and catalyst activation can be carefully controlled.

Passes in Vertical Tower

Evaporation of solvent in the first pass inhibits activation of catalyst. The second pass, relatively solvent-free, permits the catalyst to be activated. Temperature of the initial zones should range from 160° to 290° F., depending on solvent and curing mechanism. The final zone should be set at 480° F. to remove final traces of volatile material, bring out the optimum mechanical and electrical properties of the silicone rubber, and obtain maximum bond between rubber and fabric.

There are other features of a vertical tower that can help to produce superior silicone rubber-coated fabric. Insofar as the fabric is concerned, its tension and speed are controlled by a compensating unit which permits the splicing of additional rolls of fabric without stopping the equipment. The compensator also acts as a sensing element for tension control. In the case of fabrics less dimensionally stable than glass (e. g., nylon), compensation for shrinkage or stretch is automatically performed. The compensating unit is an intricate mechanism that effects control by synchronizing the activation of four motors.

The first motor controls the "let off" of the fabric from the stock rolls, providing the vertical equipment with fabric at a controlled rate. A second motor controls the drive of skyrolls, also adding an additional control for tension and speed in the same direction. Another motor controls tension between the coating machine and the windup. The fourth motor controls the final windup. The compensating unit is constantly monitoring the system of motors by activating and stopping their function, as required. The total effect of this system is a balance of the direction of tension, so that a minimum of stress is imposed on the fabric.

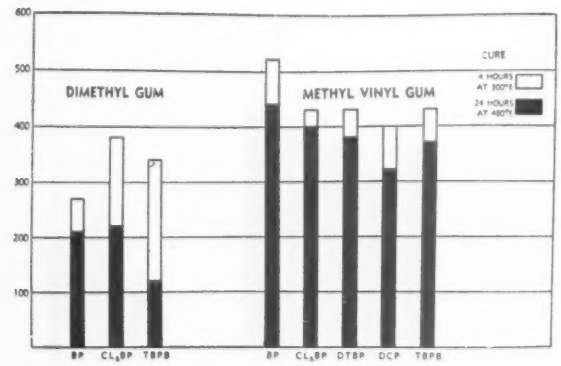


FIG. 6—Per cent elongation at break for dimethyl and methyl vinyl gum stocks for various cures, using the amount of peroxide to give maximum tensile strength.

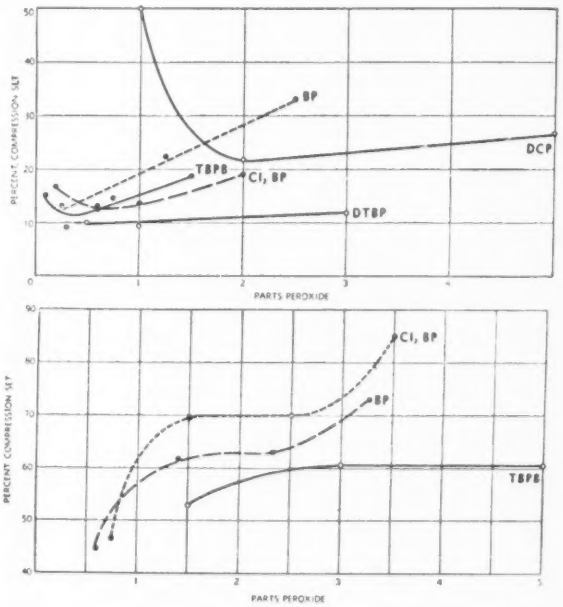


FIG. 7—Effect of type of peroxide on compression set. Upper graph, methyl vinyl gum stocks; lower graph, dimethyl gum stocks; both stocks cured 24 hours at a temperature of 480°F.

In addition to metering bars, there are other methods of controlling the application of silicone rubber coating to fabric. These include speed, dwell time and viscosity. Speed is controlled through the compensating unit, as a function of the fabric movement through the solution. The dwell time is measured by constant control of solution level in the tank. An automatic viscometer controls the percentage of nonvolatiles in the solution by adding required amounts of solvent.

DETECTION OF FAULTY COATING OR CURING, PROBABLE CAUSES AND CORRECTIVE ACTION

Symptom	Probable Cause	Recommended Action
(1) Blisters	Too high temperature in first zone.	Maximum temperature of 125° to 135°C. Check accuracy of temperature readings. Determine best remedy by trial and error.
	Too heavy a build on cloth.	Use multiple coats, if coatings heavier than 0.004 in. per side are required.
	Too low temperature in first zone. Rubber not curing in first zone.	Adjust temperature.
	Too high coating speed.	Slow down operation.
(2) Pin Holes with Blisters	Rapid removal of decomposition products.	Same as above.
(3) Pin Holes without Blisters.	Too much heat during cure cycle.	Higher temperature in first zone.
(4) Tacky Cure.	Improper use of curing agent.	Increase temperature in first zone.
(5) Contaminated Coatings.	High electrostatic charge induced in rubber.	Ground the coated material.
(6) Poor Bond to Base Cloth	Glass cloth—insufficient final cure; organic cloth—no sizing.	5 to 10 minutes at 480° F. final cure. Use 10 per cent wash coat on cloth prior to coating.
(7) Low Dielectric Strength	Defective coating.	Examine material to decide which of above symptoms obtains; follow recommended remedies.
(8) Poor Moisture Resistance	Highly sized cloth.	Use desized cloth.
(9) Rough Finish.	Poor base cloth.	(a) Handle base cloth less before coating. (b) Switch to finest fiber base cloth available—i.e., "D" fibers.
(10) Incorrect Coating Thickness.	Improper setup.	(a) Adjust dilution of solution dip tank. (b) Adjust knife setting if a knife coating operation.
(11) Low Elongation of Coated Rubber	Too much curing agent.	Dilute with uncatalyzed rubber solution.

The Western Backing Corp. plant in Culver City, Calif., has an additional control over coating thickness and weight. This is an electronic device emitting *beta* rays through coated fabric during coating. Analysis of transmission rate is automatically recorded on a chart, and translated into weight and thickness. For silicone rubber coatings of greater thickness, the horizontal oven cure has been found more effective.

The Horizontal Oven

A horizontal oven is ideal for coating silicone rubber pastes and high-viscosity solutions. The ideal condition is a multiple-pass drying oven with independently controlled zones. The first pass or zone handles solvent removal at a normal temperature range of 120° to 300° F., depending on coating thickness, solvent and curing agent. The second zone is used for either "B" staging or final cure, in compliance with product requirements. Heat in this zone can range from 120° to 600° F.

In order to ensure uniform solvent removal and proper cure, air velocity and fresh air volume is distributed uniformly over the web passing through the temperature zone. The Culver City plant also has a fume and solvent incinerator (catalytic unit), operating at 1100° F. This eliminates the emission of noxious and explosive gases to the atmosphere.

An important part of the horizontal equipment is

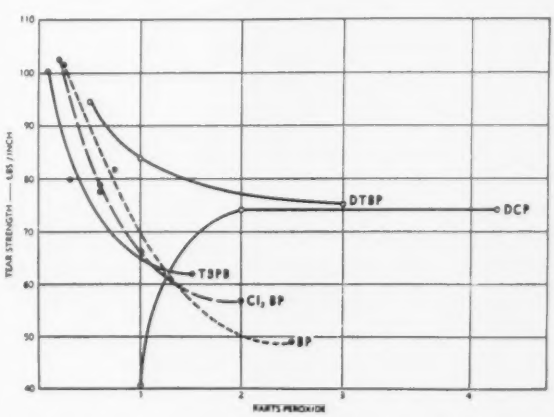


FIG. 8—Effect of type of peroxide on tear strength for methyl vinyl gum stock.

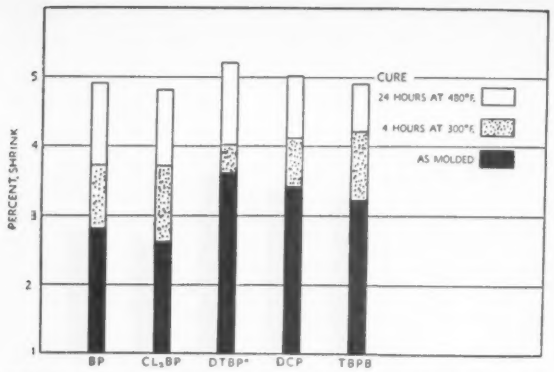


FIG. 9—Effect of curing conditions on shrinkage for methyl vinyl gum stock, using peroxide to give maximum tensile strength.

the unroll stand for feeding fabric through the coating head and temperature zone to the winder stand. An effective unroll stand is equipped with air brakes, precision-controlled to distribute tension uniformly throughout the web. This serves to reduce variations in the winding of base fabric to a minimum.

The coating head serves as applicator of silicone rubber film to the base fabric. For uniform results, Western Backing Corp. has designed a coating head that can coat either one or both sides of the fabric at the same time. It also functions as a single or double floating knife or sequential coater. This has eliminated the objection to horizontal coaters that can coat only one side at a time.

A cooling system is located between the dryer and rewind. It consists of large-diameter pull rolls which are cooled with refrigerated water. It reduces the coated fabric to room (or lower) temperature before rewinding. The winder stand is mounted on a rail, permitting lateral movement, monitored by an edge guider to ensure the winding of straight rolls. Constant speed and tension input controls provide effective correlation to the entire system.

Silicone coated fabrics are usually produced to customer specifications. Custom coating requires a laboratory pilot run, then a pre-production run. This procedure is necessary in order to establish proper formulation and correct heat-treatment for a compound. During these phases, the coated fabric is checked for signs of defective coating or curing. Finally, corrective action must be taken and production specifications established.

Coming Soon . . .

Vulcanization of Polysiloxanes: Accelerated Electrons and High Temperature Ambients—by David J. Fischer and Vernon Flegel, Dow Corning Corp., Midland, Mich.

The purpose of this paper is to study individually and simultaneously the effect of intensity and temperature on the efficiency of vulcanization by accelerated electrons and to compare these treatments with the effects of equivalent cobalt sixty irradiation.

Vulcanized-on-Sole Process: Part III—By A. W. Niconchuk, United Shoe Machinery Corp., Beverly, Mass.

The third of a four part series gives data on adhesives and curing in this description of a vital development in the production of rubber-bottomed footwear.

Elastomers for Use in Radiation Fields: Part VII—By Robert Harrington, Hanford Laboratories, General Electric Co., Richland, Washington.

Continuing the study of specific variables. Data and discussion are presented on the effect of various filler loading materials on radiation induced changes.

Compounding Silicone Rubber for Oil Resistance—By Robert L. Daileader, Silicone Products Department, General Electric Co., Waterford, New York.

Silicone rubber is a proven temperature resistant elastomer. New types have improved oil and fuel resistance for auto, plane and electrical applications.

PLUS R/A SPECIAL INDUSTRY REPORT

Music for the Rubber Production Line

Pleasant listening may mean greater efficiency and higher output, according to recent psychological studies. The objective is to soothe the harried worker without putting him to sleep.

EDITORIAL

This is the Rubber Industry

► Going abroad. Meeting new people. Learning new techniques. Interested. Alert. Contributing to better understanding between people and nations. This is the modern rubber industry — going abroad on a charter flight to attend technical meetings on the Continent. The picture stresses, more than words can relate, the new international "flavor" of the rubber industry. The International Rubber Conference held last November in Washington; The Second International Synthetic Rubber Symposium in London; The Third International Rubber Quality and Packing Conference in Singapore; The International Rubber Conference in Berlin, all betoken the new rubber industry — an industry of which we are proud to be a part.

Note: The gentleman in the oval is M. E. Lerner, editor and publisher of RUBBER AGE. His exclusive reports on the London and Berlin meetings appear elsewhere in this issue.

Special Industry Report

Capital Loans

By ROBERT B. SCOTT

Mercantile Discount Corporation
Chicago, Illinois

(1) Who is eligible for these capital loans and what are the requirements?

Any rubber manufacturing company —or rubber products manufacturer— with a history of growth is eligible for these long-term capital loans. However, there are four specific conditions involved:

(a) The company must show that it has a competent management team and is not dependent upon one man.

(b) The company must have a history of profits and show evidence of realistic expansion possibilities.

(c) The company must show how the new cash will be used to help expand sales and increase profits.

(d) The company must demonstrate an ability to repay the loan over a five year period.

(2) How do these loans differ from bank loans?

Bank loans are wonderful—if you can get them. But the era of tight money through which we have been passing in the last few years has held back all companies except the giants. The smaller and medium-sized companies with net worth from $100,000 to $1,000,000 have been hobbled in their growth because their major source of funds is bank loans, and bank funds have been pretty tight these last few years.

More specifically, when banks make loans to commercial borrowers, they look pretty hard at the borrower's net worth, and restrict their loans to some percentage of the net worth. For example, to borrow $1, a manufacturer must have $4 in net worth. This is the general banking rule.

Then also, if the bank loan is unsecured, there is a matter of a compensating balance—i.e., the borrower must leave on deposit from 15% to 20% of the loan. This, too, tends to cut down the cash available to the borrower.

However, for long-term capital loans, administered by Mercantile Discount Corporation, growth companies are judged on the basis of their current sales and earnings potential, rather than on the basis of their present assets and net worth—although these latter are of importance as collateral. It is the growth possibility which distinguishes a progressive booming company from a stodgy mature company interested only in sitting still. Also, under these loans, there are no compensating balances involved. The entire amount is available to the borrower.

Within the last three years, a new, quiet development in financing has been taking place. It is like a lend-lease plan for private industry. Only about $80,000,000 in loans are involved to date, but because $2,850,000 went into rubber products, the editors believe that a discussion of this new form of financing will be of great interest to readers.

Many leading lending institutions have been experimenting with capital loans designed mainly for manufacturers. The long-term loans, up to five years, are channeled through a commercial discount corporation which then administers the financing operation.

These long-term loans are unique because no share of ownership or profit is involved. The minimum loan is $75,000; the maximum is $2,000,000.

The Mercantile Discount Corporation, founded in 1917, is one of the oldest and largest commercial finance companies in the country. Company president Robert Scott kindly consented to prepare this Special Industry Report for the readers of RUBBER AGE. His discussion is in the form of six questions and answers.

(3) Is there any restriction on how these capital loan funds may be used by the borrower?

Insurance company loans carry restrictions on dividends, salaries, balance sheet ratios, etc. Bank loans also carry the same general type of restrictions. But the Mercantile Discount capital loan program does not have any such restrictions.

How one company in this industry used its $390,000 long-term loan may be gauged from the hypothetical balance sheet of the imaginary XYZ Rubber Company. It will be noticed that the company improved its cash position by $50,000; working capital improved by $310,000; and its current ratio became 2.48-to-1 from 1.04-to-1. This company was able to clean up short-term bank indebtedness, liquidate more than half the past-due payables, and substantially improve its credit rating—without adding partners or selling stock.

Since the company's major difficulty was the fact that it didn't have enough working capital to keep up with its growing sales, a large share of the long-term loan was funneled into working capital uses. Actually, the funds might be and have been used for other purposes also: to accumulate inventories in advance of seasonal demand, to purchase new or specialized machinery and equipment, to buy out minority stockholders or partners, to effect a merger, etc. So long as the funds are used for a constructive business purpose, they are acceptable.

(4) What about cost of such long-term capital loans?

This is one of the disadvantages of this program; the *interest rate* normally works out to be higher than bank rates. But if long-term bank cash is not available at any rate, or if bank loans are too small to carry the burden, what good does a lower rate do?

In the case of the XYZ rubber products company, the increase in working capital was $310,000. Normally, in the rubber products manufacturing industry, *earnings on working capital* average around 20 per cent after taxes—or 40 per cent before taxes. In the case of the XYZ rubber company, the company earned 22 per cent on net working capital after taxes—but could earn as much as 24 per cent on the working capital if the extra cash were available. The cash would be used to expand production and keep up with sales, to take trade discounts on all purchases, and to pick up raw material bargains with ready money. In short, the extra $310,000 in working capital could (and did) generate about $71,000 profit.

While the cost of the $390,000 capital loan was higher than bank cash—if a bank would make such a loan—the larger earnings, made available through the capital loan, more than made up for any difference in rate.

Balance Sheet of the XYZ Rubber Company

	BEFORE	AFTER
ASSETS		
Cash	$ 0	$ 50,000
Accounts receivable	300,000	300,000
Inventory	225,000	225,000
Total Current Assets	$525,000	$575,000
Fixed assets (net)	280,000	280,000
Other assets	6,000	6,000
Total Assets	$811,000	$861,000
LIABILITIES		
Bank notes payable	$190,000	$ 0
Accounts payable	260,000	110,000
Accrued taxes	29,000	29,000
Accrued payroll	10,000	10,000
Accrued insurance	3,000	3,000
Secured loan current	0	80,000
Total Current Liabilities	$492,000	$232,000
Long term debt:		
Capital loan	0	310,000
Total Liabilities	$492,000	$542,000
CAPITAL		
Total capital	400,000	400,000
Total Liabilities & Capital	$892,000	$942,000
WORKING CAPITAL		
Current assets	$525,000	$575,000
Current liabilities	492,000	232,000
Working Capital	$ 33,000	$343,000
CURRENT RATIO:	1.04 to 1	2.48 to 1

(5) What are the steps in applying for such capital funds?

In general the application is simple. A letter addressed to Robert B. Scott, president of Mercantile Discount Corporation at 110 South Dearborn Street, Chicago 3, Illinois, should present the following items:

(a) A general estimate of the funds required and for what purpose they would be used. For example, funds might be used for working capital, for inventory expansion, for purchase of new equipment, or for any other worthwhile purpose. The minimum capital loan is $75,000; the maximum $2,000,000.

(b) A short history of the company should be provided.

(c) An audited balance sheet with prifit and loss statement should also be included.

(6) When a manufacturer signs up for such a long-term capital loan, is there no way of terminating this financing prior to the agreed period?

The Mercantile Discount capital loans may be terminated whenever other methods of financing are available and advantageous.

The Mercantile Discount program is designed only for prosperous companies whose working capital cannot keep up with demands of expanding production and sales. It has happened that after two or three years of this program, a manufacturer has turned to public financing or bank financing and cancelled out the Mercantile Discount financing. This is to be expected. The program is precisely designed to act as a bridge from private financing to public financing, whenever the opportunity presents itself to the prospective borrower.

2nd International Synthetic Symposium Held in London on October 11-13

a special report by . . .

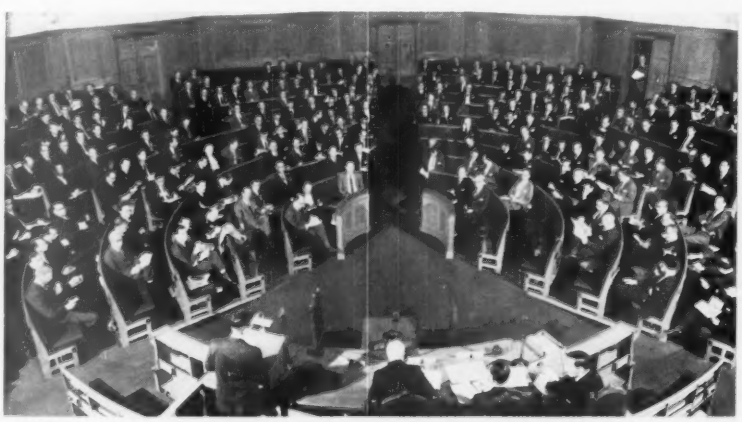
M. E. Lerner

► The Second International Synthetic Rubber Symposium, sponsored like the first by the publishers of *Rubber and Plastics Age*, one of the two rubber journals published in England, attracted an official attendance of over 800 rubber technologists, including some 120 from 17 overseas countries. Held in Church House in London, England, close by the world-famous Westminster Abbey and fairly close to Buckingham Palace, it featured the presentation of 19 technical papers, an International Rubber Exhibit, a symposium dinner, and two receptions. It was held on October 11 to 13.

Officers of the Second International Rubber Symposium included the Rt. Hon. Viscount Hailsham as honorary president, Sir Harry Melville as president, and Mr. G. E. Beharrell as chairman. Both Sir Harry and Mr. Beharrell were also present at the symposium dinner.

All of the 19 papers included in the symposium were given in the Assembly Room of Church House. As indicated by its name, Church House is the center of many of the business activities conducted under the name of the Church of England and is frequently used for ecclesiastical meetings. The Assembly Room itself is a large, circular room, with both a lower floor and balcony, equipped with comfortable seats. The acoustics in the room were excellent and overhead microphones scattered throughout the large room, all controlled from a giant electronic board located in the balcony, were switched on when necessary so that each speaker on the floor could be clearly heard.

The symposium was formally opened by Lord Hailsham on Tuesday morning, October 11. In his opening remarks, Lord Hailsham, who is Minister of Science in the British Government, expressed the hope that the visitors from abroad would find their visit both a pleasant and a constructive one. He pointed out that a great deal has happened in the rubber field since the first symposium was held in 1957, not the least of which was the fact that the United Kingdom has become a fairly important synthetic rubber manufacturer, adding that the assured expansion of the rubber industry will be such as to provide a solid economic basis for both natural and synthetic



General view of the Second International Rubber Symposium in session at Church House, London, England.

rubbers for a very considerable time to come.

The Science Minister then stated that the future alone will show that the development of combinations between natural and synthetic rubbers or the development of new types of polymers or new uses for natural rubber "may well depend on meetings of this kind." Referring to the secrecy which exists in the commercial and political fields, he said that it was his sincere conviction that the need for secrecy can be very much overdone and that "the advantages to be obtained from a frank interchange of ideas are very often underestimated." Expressing his approval of international meetings, Lord Hailsham added that "no country can remain technically in the lead unless it is constantly on the alert to improve its own ideas."

An additional word of welcome was extended by Sir Harry Melville, who functions as Secretary of the British Department of Scientific and Industrial Research, and who acted as president of the symposium. In his remarks, Sir Harry emphasized the important strides taken by the synthetic rubber industry in recent years and predicted that the future would witness the introduction of new and improved polymers which would be able to compete with other raw materials for all types of industrial applications.

Beharrell Addresses Group

The third and final speaker at the opening ceremonies was Mr. Beharrell, the official chairman. Mr. Beharrell, one of the best known figures on the international rubber scene, is chairman of the Dunlop Rubber Co., Ltd., and of the International Synthetic Rubber Co., Ltd.

In his opening statement, he pointed out that world consumption of natural and synthetic rubber may well approach 5 million tons by 1970. Referring to the position of both types of rubber he said that whereas about 38 per cent of world consumption was synthetic in 1956 that proportion was expected to rise to more than 45 per cent this year. According to Mr. Beharrell, part of the explanation for this increasing ratio lies in the increased number of synthetic rubber producers. For example, in Great Britain synthetic rubber production has risen from 1,000 tons in 1957 to a probable total of 85,000 tons by the end of 1960.

Seen here are some of the lecturers at the meeting including (left-to-right): Dr. H. Barron, Dr. F. P. Baldwin, Dr. J. F. Smith, E. L. Borg, and R. E. Headrick.

Turning toward the intensive research being carried out on *cis*-polybutadiene and *cis*-polyisoprene rubbers, the speaker said that these were synthetic rubbers which have some chance of replacing natural rubber under conditions where low heat build-up is required, as in the case of large commercial vehicle tires. He added that there is a real challenge to the natural rubber producing industry which had set up the Malayan Rubber Fund to coordinate research and development on natural rubber in Malaya and Great Britain.

Concluding, Mr. Beharrell said that the continued expansion in consumption and manufacturing capacity of the specialty rubbers, which have hitherto been more expensive than the general purpose types, may lead to cost reductions and new achievements in the development of unusual rubbers. All three speakers were introduced by A. J. Pickett, editor of *Rubber and Plastics Age*.

The 19 technical papers given at the symposium, each of approximately 45 minute duration and each followed by ample time for prepared and floor discussion, covered some of the latest developments in the synthetic rubber field. Practically every known type of polymer was touched upon, including polyisoprene, polybutadiene, butyl and chlorobutyl, SBR, nitrile, silicone and several experimental types, with both the American and European types of view presented. Rather than attempt a discussion of these papers, abstracts of all of them are appended to this report.

The International Rubber Exhibit held in conjunction with the Second International Synthetic Rubber Symposium, the first exhibition of this kind in something like 30 years, was also held in Church House, occupying two large areas near the Assembly Room. It attracted a total of 87 exhibitors covering the gamut of the rubber industry from raw materials, through machinery and equipment, to finished products.

Among the raw material exhibitors were such companies as Cabot Carbon, Columbian International,

G. E. Beharrell is shown speaking at the opening of the symposium. On his right are A. J. Pickett, editor of *Rubber and Plastics Age* and Viscount Hailsham. On his left are Sir Harry Melville and Professor C. E. H. Bawn.

Seen at the symposium dinner (left-to-right) are: Mrs. L. P. Smith, Dr. L. P. Smith (technical editor of Rubber and Plastics Age), Lady Melville, G. E. Beharrell, Sir Harry Melville, Mrs. G. E. Beharrell and A. J. Pickett.

Durham Raw Materials, R. W. Greef, Imperial Chemical Industries, Phillips Petroleum, Rubber Regenerating, Shell International and Witco Chemical. Machinery exhibits were shown by Francis Shaw, Baker Perkins, Elliott Brothers, Reed Brothers, Steele and Cowlishaw and Welding Engineers. Polymer exhibits included those by British Geon, Bunawerke Huls, DuPont, Farbenfabriken Bayer, Goodrich-Gulf, Goodyear, International Synthetic Rubber, Phillips Petroleum, Polymer (U. K.) Ltd., Shell International Chemical, Texas-U. S. Chemical and Union Carbide. Rubber manufacturers showing their wares included Armstrong Cork, Belpar Rubber, BTR Industries, Dunlop Rubber, Goodyear Tyre, Richard Klinger, Novadel, Phoenix Rubber, Rubberware, Vitafoam and Volcrepe.

The exhibit stands were uniform in size and many of the exhibits were unique in their presentations. No attendants were permitted at any of the stands and no direct selling was allowed. However, literature supplied by the various exhibitors was available at special information stands and special forms were provided on which one could indicate the specific literature he would like to secure. The exhibition commanded a good deal of attention from delegates to the symposium and many of the exhibitors expressed satisfaction with the method and the results.

The Symposium Dinner was held at the Savoy Hotel on Wednesday evening, October 12, and attracted a large number of delegates and their ladies. After an excellent dinner, toasts were proposed to Her Majesty and to "research," the latter by Mr. Beharrell, with the response by Sir Harry Melville. Mr. Pickett then proposed the toast to the guests with responses by Mr. D. Radford, chairman of the British Plastics Federation, for the domestic guests, and by Dr. I. Drogin, of the United Carbon Co., for the overseas delegates. For the most part, both the toasts and the responses were made in a light vein, although a serious note with regard to the many advantages of international meetings and exhibitions was evident. The dinner was followed by a "conversazione" which lasted for a considerable time.

Dunlop Reception

In connection with the Second International Rubber Symposium the Dunlop Rubber Co., Ltd., held a reception at the Piccadilly Hotel on Tuesday evening, October 11, and the Shell Chemical Co., Ltd., held a cocktail party at the Dorchester Hotel on Thursday evening, October 13. Both affairs were heavily attended and were deeply appreciated by the symposium delegates in attendance.

In general, all details in connection with the Second International Synthetic Rubber Symposium were well handled, even to the arrangement for special luncheons at reasonable prices at Caxton Hall, a catering establishment located a few blocks from Church House. Full credit for these arrangements goes to Mr. Pickett and his staff, including Dr. L. P. Smith, technical editor; P. W. Grange, assistant editor; and Miss Jean Thomas, circulation manager. Abstracts of the papers presented at the Symposium follow:

Tuesday, October 11th

10:30-11:15 A.M.—Mechanisms of the Stereospecific Polymerization of Dienes by Professor C. E. H. Bawn, Grant-Brunner Professor, Inorganic and Physical Chemistry, University of Liverpool.
The notable advances in methods of polymerization of dienes by which the detailed molecular structure of the product may be brought under control were briefly reviewed. The two main classes of stereospecific catalysts: (a) alkali metals and alkali metal alkyls, and (b) Ziegler type combinations were shown to be similar in function, in that they both are ionic in character and that polymer growth involves stepwise insertion in a metal alkyl chain. Mechanism of stereospecific polymerization and the influence of polymerization conditions on the structure of the polymer were discussed.

11:45-12:30 P.M.—Effect of Structural Imperfections on Certain Properties of Stereo Rubbers by K. W. Scott—Head, Basic Research, Rubbers Section, Goodyear Tire and Rubber Co., co-authors G. S. Trick, R. H. Mayor, William Saltman, R. H. Pierson. Minor amounts of structural imperfections, resulting from different modes of addition of stereo polymerized diene rubbers have been found to have only negligible effects on viscoelastic properties, but very pronounced effects on properties related to the formation of crystalline regions. The rate of crystallization is extremely sensitive to even minor amounts of structural imperfections. The tensile strength of rubbers is a typical crystallization dependent property. Tensile strengths of gum compounds of a number of high **cis**-1-4-polyisoprenes are similar at low degrees of cross-linking; however, the maximum tensile strength as well as the tensile strength at high degrees of crosslinking increases with the rate of crystallization (at —25° C.) of the rubbers in the following order: "alkyl lithium" < "aluminum trialkyl/titanium tetrachloride" < "isomerized natural" < "natural." In addition to the amount of structural imperfections, their disposition is also important. The melting point vs. composition behavior of high *cis*-1,4-polybutadienes, prepared in a variety of ways, indicates that for certain catalyst systems the structural imperfections are introduced in a non-random fashion.

2:00-2:45 P. M.—Advances in Anionic Polymerization by Professor M. Morton, Director, Institute of Rubber Research, University of Akron. Co-Authors—E. E. Bostick, R. Livigni. The use of soluble initiators of the alkyl lithium type has made possible a more detailed study of the kinetics and mechanism of anionic Although these homogenous systems do

not exhibit the degree of stereospecificity shown by the Ziegler-Natta type of catalysts, they are relatively simpler in mechanism, in that they show no sign of any termination reaction of polymerizing chains.

Recent work in this laboratory has shown that the polymerization of styrene, butadiene and isoprene can, with suitable precautions, be carried out in these systems without interference by chain termination. This leads to polymers having a very narrow distribution of molecular weights, but this distribution is very sensitive to the presence of impurities, or to other side reactions.

It has also been found that the anionic chain ends are strongly associated, in the absence of any solvating medium, *e.g.*, ethers, tetrahydrofuran, etc. Viscosity measurements on the polymerizing solutions and kinetic data indicate that the association of these macromolecules is generally in pairs, and that such chain-end pairs show a much slower polymerization rate than the "free" carbanions which exist in a solvating medium, *e.g.*, tetrahydrofuran.

This association phenomenon is apparently general for the organometallic system carbon-lithium, and was present in all the cases studied, *i.e.*, styrene, butadiene and isoprene. Hence, the unique feature of the stereospecific *cis*-1,4-polymerization of isoprene must be due to the special steric factors involved in the entry of an isoprene unit into the region of the associated chain ends.

2:45-3:30 P.M.—The Dynamic-Mechanical Properties of Filler-Loaded Vulcanizates by A. R. Payne, Senior Scientific Officer, Physics Division, Research Association of British Rubber Manufacturers. Dynamic mechanical measurements were made on butyl rubber containing varying amounts of a High Abrasion Furnace black. The measured dynamic modulus, G, decreased with increasing strain amplitude of deformation, and tan δ (the loss angle) increased from a value approximating, to that of, a pure gum rubber to a maximum at a critical point. The modulus changes were expressed in terms of G_0; the complex shear modulus at low strains and G_{∞}, the complex shear modulus at very high strains. The behavior of the filler-loaded vulcanizates can be explained by these different mechanisms: (a) the effect of weak linkages due to carbon black structure; (b) the hydrodynamic effect of the presence of particles of carbon black; (c) additional effective cross-linking due to strong rubber-black linkages. Most of the modulus changes occur at strains below 0.5 and in strain regions to which rubbers are normally subjected in service. The effect of HAF black was studied in other polymers including SBR, neoprene, *cis*-polybutadiene and some fluorinated materials and natural rubber.

4:00-4:45 P.M.—New Controlled Structure Polymers of Butadiene by W. W. Crouch, Assistant Director of Research, Phillips Petroleum Co., Co-Author, J. N. Short. An active area of research in many high polymer laboratories is the use of stereospecific catalysts to prepare polymers of controlled structure. Hundreds of polybutadiene elastomers have been made of widely varying *cis*, *trans* and vinyl structures. Four of these products have been selected for plant production or market development.

The product of greatest commercial interest is *cis*-1,4-polybutadiene of about 95 per cent *cis* content. Due to its low heat build-up and excellent abrasion resistance, this material has given outstanding performance in tire tread compounds. At least seven concerns now have plans to construct full-scale plants for the production of this type of rubber. *Trans*-polybutadiene of 85 to 90 per cent *trans* content is another interesting polymer for use in hard rubber stocks. It is currently being marketed from a semi-commercial plant. Two other butadiene elastomers under market study include a 75/25 butadiene-styrene copolymer and an 80 per cent *cis*-polybutadiene of interest in low temperature application.

Another interesting family of polymers includes polybutadienes having chain ends terminated by reactive chemical groups. These "telechelic" polymers react during vulcanization to tie the chain ends into the vulcanization network. It is expected that these and many other new "tailor-made" elastomers will be entering commercial production within the next few years as a result of the use of stereospecific catalyst systems.

Wednesday, October 12th

9:00-9:45 A.M. — Polyisoprene Rubber by F. W. Hannsgen, Research and Development Manager, Synthetic Rubber Division, Shell Chemical Co. A start will be made with the large commercial scale production of polyisoprene rubber this autumn, following a year and a half of intensive product development work. The significance of the development of processes to make stereospecific elastomers on a commercial scale is explained in terms of the world-wide supply and demand position for natural and synthetic rubbers. The availability of stereoregular polymers will assure ample supplies of a raw material for end-uses where previously available synthetics were technically inadequate.

In spite of the striking similarity our analytical data show between synthetic polyisoprene rubber and Hevea, there are certain differences that manifest themselves in processing and handling characteristics, as well as in the final product properties. The narrow molecular weight distribution, for example, creates what is termed "anomalous Mooney behavior" necessitating small but important changes in compounding techniques.

The versatility of polyisoprene rubber in a multitude of applications is evident by examining its gum and loaded physical properties, as well as through a brief summary of the successful utilization of this polymer by the consuming industry. Industry plans for installing stereoregular polymer production facilities were reviewed and related to estimated demand.

9:45-10:30 A.M. — Rheological Properties of cis-Polybutadiene and Other Polymers by D. Bulgin, Manager, Physical Research Dept., Dunlop Research Centre. *Cis*-polybutadiene in the uncompounded state exhibits a sharp change of properties on the mill at a critical temperature in the region of 40°C. Below this temperature the material mills satisfactorily, but above it the material sags and crumbles so that there is only a narrow temperature range for satisfactory milling. An extensive investigation into the cause of this change in properties has been made, involving measurement of the stress and elongation conditions of the material on the mill rolls, tensile tests on the unvulcanized material and flow and recovery experiments on laboratory instruments.

A tentative explanation is that under the stress and temperature conditions in the nip of the mill, molecular alignment takes place, leading to formation of crystallites which "melt" above the critical temperature. This is consistent with G. Natta's views on polymorphism in linear polymers. The effect of this phenomenon on extrusion experiments using laboratory instruments was also discussed.

11:00-11:45 A.M.—Polybutadiene Rubber by E. F. Engel, Manager, Synthetic Rubber Research and Development, Chemische Werke Huls, A.G. The results of mass polmerization of polybutadiene in a continuous operating polymerization extruder were discussed. Based on the stage of development described in a lecture in Berlin on October 5th, a further topic was the possible application of modification methods and the Mooney control in polymerization, as a necessity for the manufacture of polybutadiene/oil batches. Finally, there was a discussion about the field of polybutadiene/carbon black masterbatches.

11:45-12:30 P.M. — Physical and Technological Properties of cis-polybutadiene by Professor G. Natta, Director, Instituto di Chimica Industriale del Politecnico, Co-Author, S. Leghissa. During these last years, all the four foreseen types of stereoisomeric polybutadiene, each containing practically only a kind of monomeric unit, characterized by the type of enchainment and of steric structure have been obtained at high steric purity, using different stereospecific catalysts. Among them *cis*-1,4-polybutadiene roused a particular interest, owing to its excellent elastomeric properties. Properties and characteristics of a high *cis*-1,4-content polybutadiene, the synthesis of which will be easily realized on a commercial scale, were described.

The polymer containing 97 to 98 per cent or more *cis*-1,4-units, obtained with homogeneous catalytic system, shows such structural properties (purity, steric, homogeneity, crystallinity, melting range, very low dispersion of molecular weights, etc.) that it marks a sharp differentiation with regard to the other polybutadienes described up to now. In particular, the mechanical properties in non-reinforced products and the technological properties of workability appear to be remarkably improved.

2:00-2:45 P.M. — Tread Wear Indices of Various Synthetics Elastomers Measured in Varying Severity Road Tests by R. G. Bauman, Manager, Tire Research, B. F. Goodrich Co. Co-Authors, R. L. Marlow, R. F. Miller, J. L. Ginn. The very wide diversity of the wear properties of the newer synthetic rubbers requires the development of improved tire tread wear tests. Tires have been tested under constant severity conditions which provide rates of wear varying by a factor of 1,000. The lowest severity of wear employed for these tests was obtained in straight ahead driving at a constant 40 m.p.h. and the highest severity by cornering continuously at a centripetal acceleration of 12 ft./sec^2.

The relative tread wear of two compounds is affected not only by the average

severity of a given road test, but also very markedly by the particular combination of severities encountered as the car accelerates, decelerates, corners, or travels at constant speed. Because of the combination severity effect, two road tests may result in widely different wear on test tires of identical construction, even though the control tires show the same loss.

Cis-polybutadiene — natural rubber blends show remarkable abrasion resistance particularly under conditions of moderate and high abrasive severity. SBR is also known to provide some improvement over natural rubber in the same range of severity. On the other hand natural rubber shows relatively less wear at very low severity. Consequently, in order to provide an adequate evaluation of a new rubber, the wear tests must combine a carefully controlled range of severities which are related to their ultimate application. Only from information obtained in this manner can new polymers be used in tire treads to the best advantage.

2:45-3:30 P.M. — Carbon Black Structure Effects in Synthetic Rubbers by E. M. Dannenberg, Director of Carbon Black Research, Godfrey L. Cabot Inc. Co-Authors, T. D. Bolt, R. E. Dobbin, R. P. Rossman. The objectives of this study were to estimate the relative degree of primary structure characteristics of carbon blacks and to determine the effect of changes in this property on rubber performance. Relative differences in primary structure influence oil absorption and dry compression void volume measurements and, in unvulcanized rubber mixtures, influence extrusion die swell and plasticity. The stress-strain behavior of vulcanized compounds can be drastically altered by structure changes. Extreme lowering of structure results in difficult dispersion behavior which can be partially overcome by special mixing techniques. Whereas moderate structure lowering from the levels of presently used blacks is desirable for certain applications, the extent to which this can be done is limited by dispersion difficulties and loss of reinforcing ability.

4:00-4:45 P.M. — Relationship of Intrinsic Viscosity to the Intrinsic Vistex Viscosity and Plasticity of Cold Styrene-Butadiene Rubber by E. W. Duck, Koninklijke/Shell Laboratorium. Co-Author, J. A. Waterman. The primary evaluation of unvulcanized styrene-butadiene rubber samples involves the determination of the intrinsic viscosity (IV) of the soluble fraction of the dry rubber, or the related intrinsic vistex viscosity of the latex, and determination of the percentage gel present. A good correlation was found between IV and vistex, namely: intrinsic vistex M 0.75 (IV).

Another useful characteristic is the Hoekstra plasticity, which can be determined on very small rubber samples (about 1 gr.). A linear relationship between the inherent viscosity (taken instead of the intrinsic viscosity in this part of the work) and the Hoekstra plasticity was found for cold styrene-butadiene rubbers of low gel content:

Inherent Viscosity (M IV) = 0.0326 (Hoekstra) + 0.808. This relationship appears independent of conversion over a large range (27 to 93 per cent), and at normal conversion (60 to 65 per cent) it is also independent of the degree of modification and of the emulsifier employed. Comparative measurements of Hoekstra plasticity and Mooney viscosity, which requires larger samples, are given for S-1,500-S type rubbers prepared to conversions in the range 60 to 65 per cent.

Thursday, October 13th

9:00-9:45 P.M. — Vulcanization and Elastomeric Properties of Ethylene-Propylene Copolymers by Professor G. Natta, Director Instituto di Chemica Industriale del Politechnico. Co-Author, G. Crespi. The ethylene-propylene copolymers obtained with some active catalysts, with anionic coordinated mechanism, show a statistical homogeneity, have a regular linear head-to-tail structure and an easily regulated high molecular weight. Owing to their visco-elastic properties, they must be considered very interesting raw materials, suitable for several applications in the elastomeric field. Excellent rebound properties, very low brittle point, together with high aging stability, connected with their chemical nature of substantially saturated hydrocarbons, are the most significant characteristics of this new type of elastomer.

The crosslinking of ethylene-propylene copolymers, owing to their saturated nature, cannot be effected by the usual methods employed in the field of unsaturated synthetic rubbers, unless a certain number of double bonds are introduced in the macromolecule free radicals (*e.g.*, produced using non-volatile organic peroxides) especially in the presence of small amounts of sulphur, allowing crosslinking of these new saturated elastomers, operating under thermal conditions, which are very similar to those usually employed for other rubbers. The addition of sulphur gives better curing yields in respect with the employed peroxide, and gives rise to a higher crosslinking degree. Data on the physical and chemical properties and on the chemical and aging resistance of rubbers, obtained from ethylene-propylene copolymers, cured in the presence of reinforcing agents (carbon black, silica, etc.), were reported in comparison with other elastomers.

9:45-10:30 A.M. — Preparation and Properties of Chlorobutyl by F. P. Baldwin, Research Associate, Esso Research and Engineering Co. Studies of the chlorination of butyl rubber with elemental chlorine at about 25°C. reveal that the primary and preferred reaction is one of substitution at the isoprene residue. The reaction is very sensitive to halogen level and, unlike bromination, chlorination beyond one chlorine atom per isoprene residue leads to rapid polymer degradation. The incorporation of reactive allylic chlorine into the butyl rubber molecule provides for numerous vulcanization modes. Crosslinking can be effected not only by conventional sulphur/accelerator combinations but also by bis-alkylation reactions. Zinc oxide and certain organic zinc salts also are effective crosslinking reagents.

Because of the diversity of curing methods available, vulcanizate properties can be made to vary widely. Co-vulcanization with, and adhesion to, other rubbers is possible, and compounds having excellent resistance to dynamic flexure and heat exposure are readily prepared. The increase in cure rate and the new range of cured properties available with this rubber, foretell expanded application areas for butyl type polymers. Impermeable tubeless tire innerliners, protective veneers, heat resistant belting and hose, non-contaminating tubing and tanks and miscellaneous quality mechanical goods items are examples.

11:00-11:45 A.M.—Modern Nitrile Rubber Technology by I. W. E. Harris, Research and Development Division, Polymer Corporation Ltd. Co-Author, H. A. Pfisterer. The history of the development of nitrile rubbers was briefly traced up to the introduction of the low temperature types in Canada in 1950. The basic properties controlling the behavior of nitrile rubbers were discussed with special reference to the effect of non-polymer components on the color and curing behavior of the rubber and the effect of Mooney viscosity and acrylonitrile content on the processability and vulcanizate properties.

Polymer-polymer incompatibility and the consequent presence of one polymer component as a micro-disperse phase was shown to improve processability and, in some cases, the vulcanizate properties. Examples of this phenomenon are drawn from the application of rubbers as plasticizers for thermoplastic resins and the use of a crosslinked nitrile rubber as a processing aid. Compounding principles that provide improved heat resistance and ozone resistance were discussed.

11:45-12:30 P.M.—High Solids SBR Latex By a Chemical Promoted Agglomeration by E. L. Borg, Group Manager, Synthetic Rubber, Latex and Colloidal Products Research & Development, Naugatuck Chemical Division, U. S. Rubber Co. Co-Authors, L. H. Howland, E. J. Aleksa, R. W. Brown. For many applications, particularly in the manufacture of foam sponge, a high solids, large particle synthetic rubber latex is required. The polymerization of such a latex is slow and costly. In contrast, the polymerization of the small particle synthetic rubber latices is rapid. The small particles in a latex taken from a rapid polymerization can be agglomerated to the large size required in high solids applications.

Certain high molecular weight chemicals will promote latex particle agglomeration. Polyvinyl methylether is particularly effective and its utility is enhanced by a close control of its molecular weight and structure. A practical application of polyvinyl methylether to the post-polymerization agglomeration of a small particle SBR latex has been made. A commercial large particle, high solids latex is produced in this way. This latex is particularly useful in the manufacture of foam sponge and for other applications where its features of large particle size, high solids, and low viscosity are desirable properties.

2:00-2:45 P.M.—Elastomers for Advanced Design Flight Vehicles by R. E. Headrick, Elastomer Research Engineer, Wright Air Development Division. This paper gave a discussion of the research efforts by the United States Air Force on elastomeric and compliant materials for use in advanced design flight vehicles. The presentation was specifically concerned with the behavior of elastomers under a wide variety of environmental conditions, including extremes of temperature and pressure, nuclear radiation, and resistance to the degrading action of solvents and chemicals

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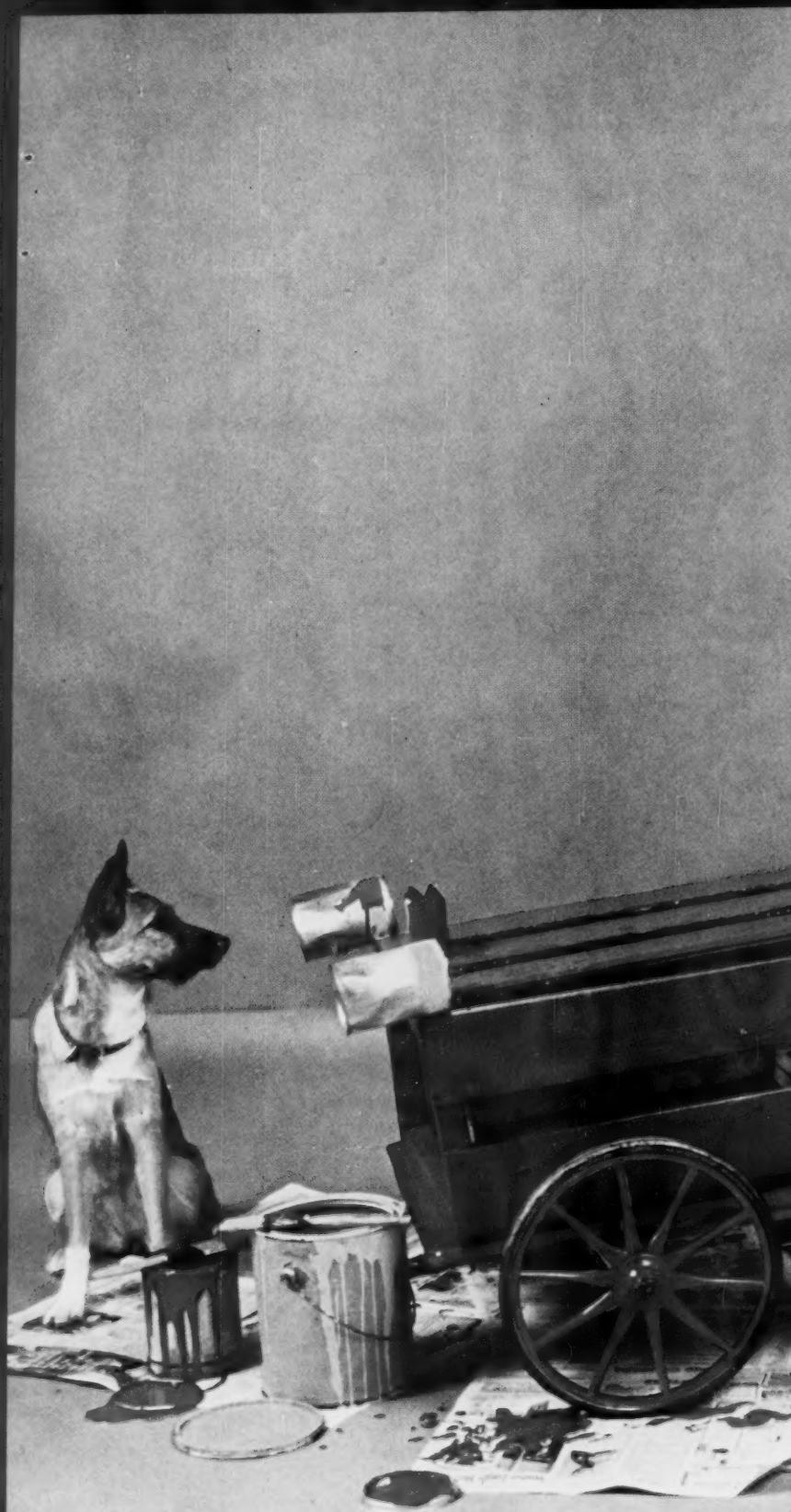

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including the various liquid fuels and oxidizers. Tailor-made polymers are considered one important approach for the development of rubber compounds for these extremely complex problems. A few of the more promising new elastomeric polymers being investigated by polymer chemists were discussed, pointing out the inherent problems and limitations of the polymer systems. The importance of polymer research was emphasized as the only approach for the achievement of the "ideal elastomer."

2:45-3:30 P.M. — The Mechanism of Post Cure of 'Viton' A Fluorocarbon Elastomer by J. F. Smith, Research Chemist, Elastomer Chemicals Department, E. I. du Pont de Nemours Inc. Co-Author, G. T. Perkins. The presently available methods of vulcanization of Viton A fluoroelastomer were reviewed. All require a long, high temperature post cure in order to develop optimum properties. The necessity for the post cure was explained in the following way: The formation of crosslinks during vulcanization is accompanied by the elimination of HF from the polymer. Reaction of HF with magnesium oxide present as acid acceptor then forms water which acts to inhibit the full development of cure unless it is removed from the vicinity of the polymer by a post cure in an open system. Measurement of the rate of elimination of water from the polymer serves as a method of following the development of crosslinks during cure. Approximately two moles of water, derived from four moles of hydrogen fluoride, are associated with the use of one mole of diamine curing agent. This ratio is confirmed by independent estimates of the relationship of crosslink density to curing agent level, made by measurements of swollen compression modulus.

4:00-4:45 P.M. — Silicone Rubber Compounding by P. C. Servais, Manager, Silastic Section, Product Engineering Laboratories, Dow Corning Corp., and I. H. Riley, Manager, Rubber Laboratory, Technical Service Dept., Midland Silicones Ltd. This paper discussed the advantages and disadvantages of silicone rubber compounding by rubber processors and the reasons for the increase in this aspect of silicone business. A comprehensive review was made of the materials available to the processor and indications given of the ways in which the properties of the rubber can be changed by suitable choice of fillers, additives and curing agents. The relative merits of compounding from gum or gum-filler masterbatches were discussed. A brief description was given of the equipment required for silicone rubber compounding and the recommended methods of working.

Marbon Group Leader

► Ralph M. Levine has joined Marbon Chemical Division, Borg-Warner Corp., Washington, West Va., as group leader in charge of coatings and latices. He is a graduate of the University of Glasgow and was formerly associated with Vinyl Products Ltd., England.

Seen at the 6th JANA Elastomer Conference are (left-to-right): H. L. Nash, G. N. S. Farrand, J. C. Montermoso, J. M. Kelbe, J. H. Faull, Jr., and H. Warburton Hall.

Defense Groups Hold Conference

► More than 250 persons attended the Sixth Joint Army-Navy-Air Force Conference on Elastomer Research and Development held on October 18 through 20 at the Statler-Hilton Hotel in Boston, Mass. Dr. Juan C. Montermoso, chief of the Quartermaster Research and Engineering Command, served as general chairman for the meeting which featured the presentation of 46 technical papers and a banquet on the evening of October 19.

The first session was held on Tuesday morning, October 18, with Dr. Montermoso presiding. Opening remarks were made by Dr. G. R. Thomas (QMR & EC). The introduction to the meeting was made by Brigadier General Merrill L. Tribe, commanding general (QMR & EC) and the welcoming address was delivered by Major General Roy T. Evance, Jr., Deputy Quartermaster General. Abstracts of all the technical papers presented at the meeting appeared in the September, 1960, issue of RUBBER AGE.

The second session, held in the afternoon on October 18, was devoted to "Basic Polymer Research." This session adjourned at 5:00 p.m. and continued on Wednesday morning. J. M. Kelbe (WADD) served as session chairman. The third session began on Wednesday morning, and was concerned with "Special Applications." Dr. J. H. Faull, Jr. (Office of Naval Research) served as chairman. The fourth and final session of the conference began the morning of October 20 and dealt with "New Elastomers." Dr. R. F. Dunbrook (Firestone), headed this session. Dr. Dunbrook is chairman of the Panel of Elastomers and Coated Fabrics of the National Research Council Advisory Board on Quartermaster Research and Development.

It is interesting to note that of the 46 technical papers presented, 32 were concerned with basic polymer research; nine with new elastomers; three on European and English research, and two on Defense Department policies in respect to basic research.

Latest Missile Developments

Dr. Richard Weiss, scientific director of the Army Research Office, was the principal speaker at the banquet. Dr. Dale H. Sieling, scientific director of the QMR & EC, served as toastmaster. In his address, Dr. Weiss discussed the latest developments in rockets, missiles and earth-moving equipment.

Military expenditures on elastomer research annually exceed one million dollars, Dr. Weiss said. As new developments emerging from military research, he cited prosthetic devices such as artificial arteries made of acrylate polymer, protective clothing to insure man's survival in a hostile environment, and elastomers that can withstand fuel and oil attack at high temperatures and pressure.

Proceedings of the meeting, distributed without additional cost to registered attendants of the conference, will be ready in a few months. Others may obtain the proceedings at a cost of $10.00 each, by writing to the general chairman, Dr. J. C. Montermoso, Chief of Elastomer Branch, Quartermaster Research and Engineering Command, Natick, Mass.

Rubber Hall of Fame Adds Henry Ridley

► Henry Nicholas Ridley, English naturalist whose "Herring-Bone" tapping method made possible the production of natural rubber in large quantities, has been elected to the University of Akron's International Rubber Science Hall of Fame. The installation ceremonies took place at the annual Rubber Science Hall of Fame Banquet and Symposium held on the University campus November 18.

Mr. Ridley (1855-1956), also a botanist, geologist, explorer, author and editor, was the seventh member of the Hall of Fame. The others are: Charles Goodyear, C. Greville Williams, Carl O. Weber, Henri Bouasse, Ivan I. Ostromislensky, and Thomas Hancock.

Mr. Ridley, while serving as director of the Straits Settlements Gardens and Forests in Singapore in the late 1880's, foresaw the possibilities of the plantation system and set about to convince people that rubber was a commodity with a future. He carried on the basic agricultural research that made mass-production of rubber possible. At the time when it was thought that the rubber tree could be tapped only once or twice a year, he developed the famous "herring-bone" continuous tapping method still in use today. He proved trees could be tapped daily with no ill effects, increasing natural rubber production at a time when the automobile was just around the corner.

Hall of Fame Symposium

The theme of the Rubber Science Hall of Fame Symposium, held at the Kolbe Hall Theatre, was "Advances in Knowledge in Natural Rubber." Dr. G. Stafford Whitby, Professor Emeritus of Rubber Chemistry and Consultant, Institute of Rubber Research at Akron University, moderated the program.

The speakers were D. K. G. McIndoe, former director of research for Firestone Plantations Co., now serving as research adviser, and W. G. Wren, head of the Chemical Division of the Rubber Institute of Malaya. Dr. McIndoe discussed "Advances in Breeding Hevea Braziliensis," and Mr. Wren's topic was "Advances in the Chemical Knowledge of Natural Rubber."

The Rubber Science Hall of Fame Banquet took place in the Hilltop Room of the Student Center, and His

Henry Nicholas Ridley

Excellency Dato Nik Ahmed Kamil, Ambassador Extraordinary and Plenipotentiary of the Federation of Malaya to the United States and Permanent Representative of the Federation of Malaya to the United Nations, was the featured dinner speaker.

Mr. Ridley was installed into the Hall of Fame at the banquet. His selection was made by a committee chaired by Dr. Maurice Morton, Akron University professor of Polymer Chemistry and director of the Institute of Rubber Research. Committee members were: Dr. Thomas Sumner, acting dean of the Buchtel College of Liberal Arts and Head of the Chemistry Deppartment at Akron University; Dr. Whitby; Arthur E. Juve and Ralph Wolf from the Rubber Division of the American Chemical Society.

Forms New Company

► James G. Barbour, Jr., formerly vice-president of the Sirvene Division of the Chicago Rawhide Manufacturing Co., Chicago, Ill., has announced the formation of Koel-Bar Industries, Inc., at 21 West Elm St., Chicago 10, Ill. The firm will function as a manufacturers' representative, with clients including Baldwin Rubber Co., Garfield Rubber Products, Inc., and Post Products, Inc. Mr. Barbour spent some thirty years in close association with Herman M. Koelliker at Buckeye Rubber Co., Baldwin Rubber, Ohio Rubber and with Chicago Rawhide. When Mr. Koelliker passed away in August, 1951, Mr. Barbour succeeded him as vice-president of the Sirvene Division, a position he held until 1959.

Enjay Sets Split Of Chemical Division

► Enjay Chemical Co., New York, N. Y., has split its former Chemicals Division into two new product divisions, Industrial Chemicals and Chemical Raw Materials. E. W. Bowerman, former assistant head of Research and Development for the division, has been named product manager of the new Chemical Raw Materials Division on a rotational assignment. A. C. Matthies, former product manager of the Chemicals Division, will serve as product manager for Industrial Chemicals. The Chemical Raw Materials Division will handle ethylene, butadiene and similar chemical raw materials; the Industrial Chemicals Division will handle alcohols, ketones and related products.

Dr. Bowerman graduated with a B.S. degree in education from Northern State Teachers College in 1927. He received a B.S. degree in chemical engineering from the South Dakota School of Mines in 1933, and a Ph.D. from Ohio State University in 1937. He joined the company in 1937 as a chemical engineer in the Research and Development Division, and has been assistant head of the division for the past four years.

SORG Holds Reclaim Panel

► The Southern Ohio Rubber Group held a panel discussion on reclaim rubber on September 29 at the Engineers Club in Dayton, Ohio, with 130 members and guests present. Charles O. Moore (Dayco Corp.) served as moderator of the panel which included: Don McCollam (Naugatuck Chemical) who spoke on "Reclaim Rubber—Past—Present-Future"; Kenneth R. Garvick (Mansfield Tire & Rubber) who discussed "The Use of Reclaim in Tires and Tubes"; and John E. Brothers (Ohio Rubber) whose subject was "A Mechanical Goods Compounder Looks at Reclaim Rubber."

U.S. Rubber to Build

► U. S. Rubber Co., New York, N. Y., has announced that its Naugatuck Chemical Division will construct a $2 million pilot plant in Baton Rouge, La. for trial production of stereo regulars. Construction, to begin this year, is due to be completed in the fall of next year. The site chosen for the plant is adjacent to the Chemical Division's plastics capital.

Rubber Study Group Predicts 3.89 Million Ton Consumption

► Delegates from 19 countries attended the Fifteenth Meeting of the International Rubber Study Group, held in Kuala Lumpur from September 19 to 23. The Honorable Inche Mohamed Khir Johari, Minister of Commerce and Industry, and Leader of the Delegation of the Federation of Malaya, officiated as chairman of the meeting, and the vice-chairmen were P. J. Debart, leader of the French delegation, and His Excellency Dr. Mohamed Razif, leader of the Indonesian delegation.

Particular emphasis was placed on the statistical position of rubber, and the Group made estimates for the natural and synthetic rubber requirements and supply during 1960. It was estimated that world consumption would be about 2,070,000 long tons of natural rubber, and 1,770,000 long tons of synthetic rubber. It was also predicted that world production of natural rubber would be about 2,055,000 long tons, and synthetic, in member countries, about 1,940,000 long tons. It was expected that about 160,000 long tons of natural rubber would be delivered from government stockpiles. In the opinion of the Group, the estimated surplus of natural rubber and synthetic rubber production over consumption of 145,000 long tons and 170,000 long tons respectively would enable stocks to be rebuilt to more than normal levels.

Special attention was called to the excellent record of replanting with high yielding material, and to the growing competitive situation with regard to increased production of synthetic rubber and in particular the development of the new stereoregular synthetic rubbers. The Group stressed its feeling that every encouragement should be given to meeting and close liaison between scientists and technicians of both industries. It also expressed its satisfaction at the accomplishments of the Third International Rubber Quality and Packing Conference held in Singapore, in re-aligning the grade classifications for international recognition.

The Group called for early agreement on appropriate definition of natural and synthetic rubber for customs purposes so that trade would be facilitated; it stressed the importance of greater stability of the price of natural rubber to both producers and consumers and to countries whose economies are largely dependent on the production of natural rubber; it noted current stockpile disposals of natural rubber and expressed its appreciation to the United States and the United Kingdom, that disposal arrangements were decided after consultation with all member countries largely concerned with the production of natural rubber; it accepted an invitation to hold its May, 1962 meeting in the United States.

Finally, the organization expressed its appreciation to its retiring secretary-general, A. G. Pawson, and welcomed P. F. Adams, who will succeed Mr. Pawson on January 1, 1961.

Table I—Estimated Natural and Synthetic Rubber Consumption in 1960

(in 1,000 long tons)

Territory	*Natural*	*Synthetic*	*Total*
United States of America	506	1,114	1,620
United Kingdom	170	110	280
Federal Republic of Germany	145	95	240
France	128	88	216
Japan	161	48	209
Italy	69	46	115
Canada	40	60	100
Australia	40	20	60
Czechoslovakia	52	2*	54
Netherlands	21	11	32
Belgium	15	11	26
Austria	11	7	18
Indonesia	18	—	18
Denmark	6	3	9
Hungary	7	1*	8
Federation of Malaya and Singapore	6	—	6
Other Member Countries†	5	—	5
Other Countries	670	154	824
	2,070	1,770	3,840

* Excluding rubber produced in non-Member Countries. † Burma, Cambodia, Ceylon, Liberia, Thailand and Viet-Nam.

Table II—Estimated Natural Rubber Supply in 1960

(in 1,000 long tons)

Production

Territory	*Tons*
Federation of Malaya and Singapore	720
Indonesia	690
Thailand	160
Ceylon	92
Viet-Nam	77
British Africa	52
Sarawak	47
Liberia	43
Cambodia	35
Other British Borneo	25
Burma	12
States of the French Community and Cameroons	5
Territory of Papua and New Guinea	5
Other Countries	92
	2,055

Deliveries from Strategic Stockpiles

United States of America	95
United Kingdom	60
Italy	5
Total Deliveries	160
Total New Supply	2,215

Table III—Estimated Synthetic Rubber Production in Member Countries in 1960

(in 1,000 long tons)

U. S. A.	1,450
Canada	157
Federal Republic of Germany	90
United Kingdom	90
Italy	70
Other Member Countries	83
	1,940

Exterior view of the Kongresshalle, site of the Berlin International Rubber Conference.

German Rubber Society Sponsors International Rubber Conference

a special report by . . .

M. E. Lerner

► The International Rubber Conference sponsored by the Deutsche Kautschuk-Gesellschaft (German Rubber Society), held in West Berlin, Germany, from October 4 to 8, turned out to be the largest technical conference on rubber chemistry and technology held in Europe to date. Official registration was established as 1029, which means that almost 1200 rubber technologists, engineers, salesmen and others were in West Berlin in connection with the conference. Of the officially registered delegates, some 70 were from the United States, 60 from England, 40 from the Netherlands and 35 from France.

A total of 62 technical papers were presented over the four-day meeting, of which 54 were directly related to rubber technology, six to man-made fibers, and two were special plenary lectures. Other than the two plenary lectures, the technical sessions were held concurrently, devoted to such specific subjects as elastomers, vulcanization, testing, tires, fillers, aging, and production. The session on man-made fibers included papers on relations between static and dynamic properties of tire cords, modern viscose tire cord, nylon in tires, a new dielectric method for quickly determining moisture content of tire cord, and methods of testing and evaluating cord fatigue in tires.

Plenary Lectures

The plenary lectures were delivered by Dr. Paul Baumann, General Director of Chemische Werke Huls, A.-G., and Dr. Alfred Ebert of Vereinigte Glanztoff-Fabriken, A.-G. Dr. Baumann covered the development of synthetic rubber since 1930 and Dr. Ebert traced the development of man-made fibers for technical applications. Both lectures were thorough and laid the groundwork for the technical papers to follow, including rubber and textiles.

Other highlights at the meeting included extensive commercial and general exhibits, a general meeting of the DKG, a reception for guests of honor, the presentation of Carl Dietrich Harries plaques, a social evening, a special ladies' program, and the showing of several films of direct interest to the rubber industry. The film presentations took place on the final day of the conference and covered such subjects as the new West German synthetic rubber plant at Marl-Huls, the production of cellulose and its processing into finished products, the production of high tenacity rayon and its uses in the rubber field, the use of containers

made of rubberized fabric, and some of the rubber chemical operations of Farbenfabriken Bayer, A.-G., at Leverkusen.

Actually the meeting got underway on the morning of October 4 with an International Press Conference, presided over by Dr. G. Fromandi, of Farbenfabriken Bayer, president of the DKG. In his comments, Dr. Fromandi stated that the German Rubber Society now has some 600 members and is dedicated to the constant improvement in international rubber technology. He emphasized the point that advances in such technology to date were evolutionary rather than revolutionary and that the current conference laid particular stress on synthetic rubbers and synthetic fibers. He also commented on the fact that current world-wide consumption of new rubber was approximately 4,000,000 long tons per year with the expectation that it would reach 6,000,000 long tons per year within the next several years. The general meeting of the DKG was held on the afternoon of the same day.

Reception Tendered

The reception for guests of honor, some 60 in all, was given by the Senate of the City of West Berlin on the evening of October 4. It was held in the Senate Building (Town Hall), with the official welcome extended by Rolfe Schwedler, Senator for Municipal Buildings. The reply was made by Dr. Fromandi, with both the welcome and reply translated into English for some of the overseas guests. (For the record, the translator did an excellent job, giving a five to ten minute translation from a few simple notes).

The inaugural session of the Congress Symposia started promptly at 9:00 a.m. on October 5, with Dr. Fromandi presiding. After extending a general welcome to all of the delegates and pointing out that papers were to be presented by speakers from 13 countries, he introduced Franz Amrehn, Deputy Burgomaster of West Berlin, who extended an official welcome to the delegates. In his remarks, Mr. Amrehn stated that West Berlin was rapidly recovering from the devastation of World War II, during which some 40% of its residential homes was destroyed, and was now the greatest industrial city in Germany. He termed it a "city of development" and predicted still greater growth in the future. While the rubber manufacturing industry in West Berlin represents only 1% of industrial production, he stated that the German people were well aware of the growing importance of the over-all rubber industry to the welfare of the West German State. Following Mr. Amrehn's talk, a few additional words of welcome were given by the president of the Association of German Rubber Manufacturers.

A view of the delegates in the auditorium of the Kongresshalle. Earphones were provided at each seat for the convenience of each listener.

The first order of business at the inaugural session was the presentation of the Carl Dietrich Harries plaques (corresponding to the Charles Goodyear Medals) to Dr. Paul Baumann and Dr. Hermann Holzrichter, the presentations being made by Dr. Fromandi. Dr. Harries, who died in November, 1923, was one of the outstanding German chemists of his day and was closely related to the development of synthetic rubber. He was also noted for his research activities where ozone protection of rubber goods is concerned.

The award to Dr. Baumann was based on his extensive work in synthetic rubber technology, although he is equally as well known for his activities on the electric arc process in the petroleum field. Born in December, 1897, he was graduated *summa cum laude* from Heidelberg University in 1923, after which he joined Badische Anilin- und Soda-Fabrik at Ludwigshafen, working on gas reactions. Subsequently, he became affiliated with I. G. Farbenindustrie, A.-G., becoming an officer of that organization. While with the company he spent four years in the early 1930's at Baton Rouge, Louisiana, working with the Standard Oil Co.

Seen (left-to-right) are: Dr. Erich Konrad, honorary director of Deutsche Kautschuk Gesel'schaft; D. Schmidt, assistant secretary; A. Titze, secretary; W. Kraemer, vice-president, and Dr. G. Fromandi, president.

Dr. Fromandi (far right) is shown presenting the Harries Placques to Dr. Paul Baumann (left) and Dr. Hermann Holzrichter (center).

Dr. Baumann was one of the founders of Chemische Werke Huls, organized in 1938, eventually becoming president. He was also instrumental in organizing Bunawerke Huls, also reaching the position of president. He has also served as a professor at the Westfalischen Wilhelms University and has received official recognition from the German Republic for his chemical and rubber activities.

Dr. Holzrichter, who has been associated with Farbenfabriken Bayer since 1937, was selected for the Harries award on the basis of his work in the field of polymerization, of both the emulsion and solid type. Currently a vice-president and director of the Leverkusen organization, he is credited with singular developments in many synthetic rubber and rubber-like areas, including acrylonitrile-butadiene-styrene polymers and poly-acrylonitrile polymers in general. He is also well-known for his work in the petrochemical field which has earned him world-wide recognition.

All of the technical sessions, film presentations, award presentations, and other activities, other than social, were held in the Kongresshalle (Congress Hall). The Kongresshalle is a beautiful, odd-shaped building, with a reflector pool in front, constructed a few years ago by an American architect. Located on John Foster Dulles Allee (Boulevard), it is close to the Brandenburg Gate, where the Soviet Sector starts in Berlin, along Unter den Linden.

Facilities for meetings at the Kongresshalle are excellent and unusual. There are two large meeting halls, one called the Auditorium and the other the Vortagsaal (lecture room), both of which were utilized for the concurrent technical sessions. The auditorium is equipped with earphones at every seat, similar to those at the United Nations assembly hall in New York, so that running translations can be given of papers. This was done in English for the two plenary lectures, both of which were presented in German, but unfortunately it was not carried on for the balance of papers at the meeting, due to the high cost involved.

The exhibits shown in connection with the conference, all attractively arranged and all commanding a good deal of attention from the delegates, numbered 27 in all and covered the gamut of rubber machinery and equipment. Processing equipment, including mills, mixers and calenders, was displayed by such companies as Werner & Pfleiderer, Condux-Werke, Hermann Berstorff, Homrich Maschinen, Karl Frank and Ruth Schwabenthan. Testing equipment, including the controlled ozone test chamber featured by the Ozone Research & Equipment Corp., of Phoenix, Arizona, the only direct American exhibitor, was shown by Zwick & Co., Instron Engineering, Christiansen & Meyer, Otto Wolpert-Werke, Brabender, o. H., Buro A. Schneider, Gebr. Haake, Julius Peters, Negretti & Zambra, and Herfurth GmbH.

In addition to the above, cutting and dicing equipment was exhibited by Deutsche Vereinigte Schuhmaschinen and granulating machines by Rolf Schlicht. Special high speed photography equipment was displayed by Agfa Camera-Werk and new types of radiant lamps by Quarzlampen GmbH. Dielectric heating equipment was featured by Frieseke & Hoepfner, as well as by Franz Bergmann. Equipment for determining the tensile strength of rayon tire cord was shown by Egon Haase-Deyerling. Steel cord for tires, belts, hose and other products was displayed by the Belgian firm of Bekaert Steel Cord S/A. An interesting variety of rubber products was shown by Buna Werke Huls of Marl.

Supplementing the commercial exhibits, all confined to a special exhibit hall, were a number of general displays in the lobby of the Kongresshalle. These general displays were individually devoted to rayon, nylon 6, nylon 66 and polyester fibers. Products displayed made with these various textile materials included passenger and truck tires, bicycle tires, fire hose, fuel cells, tent fabrics, couplings, tennis balls, collapsible containers, life jackets, folding boats, adhesive tire patches, hose pipes and V-belts.

Textile Consumption

According to figures appearing on one of the lobby displays, the current consumption of textile materials by the rubber manufacturing industry in the Federal German Republic and West Berlin is approximately 79 million pounds per year, of which 55 million pounds (mostly rayon) goes into tires and 24 million pounds (mostly cotton) goes into non-tire rubber products.

The program for the ladies (of which advantage was taken by many of the overseas male delegates) included visits to the Berolina stocking factory and to one of the leading porcelain plants where some of the noted German figurines are produced, as well as a sightseeing tour of both West and East Berlin and an outing on the Havel River and the West Berlin lakes. For the male delegates, a visit to the Federal Institute for Material Testing, located in Berlin-Dahlem, proved most interesting. (The Institute resembles the Materials Testing Section of the National Bureau of Standards at Washington, D. C., in many respects).

The social evening took place on Friday, October 7, following three consecutive days of technical sessions and one day prior to the official end of the conference. It was held at the Palais am Funkturm and many of the overseas delegates were present as guests of the DKG. Some 650 attended the "evening," which included an excellent dinner and an extensive program of entertainment. A few brief remarks were made by Dr. Fromandi in his capacity as president of the German Rubber Society, expressing the appreciation of the society for the excellent attendance at the various technical sessions and for the large number of overseas guests. (Delegates from 25 countries were at the conference). An excellent linguist, Dr. Formandi first spoke in his native German and then repeated his remarks in both English and French.

Another social highlight of the West Berlin meeting was a trip on the lakes on Wednesday evening, October 5, sponsored by the Phillips Petroleum International Corporation, which maintains headquarters at Zurich, Switzerland, and of which J. O. Willums is regional manager. This trip, taken on the motorship Ernst Reuter, featured food, music and conviviality, and some 250 guests were involved. This Phillips type of entertainment has become almost traditional at conferences sponsored by DKG.

Seen on the motorship Ernst Reuter are (left-to-right) Manuel Savage (Circle Wire), Mrs. Savage, Mrs. M. E. Lerner and M. E. Lerner (Rubber Age).

Technical Sessions

As indicated above, 62 technical papers were presented during the four-day meeting in West Berlin, a complete listing of which appeared in the August, 1960, issue of this journal. The sessions covering elastomers included papers on natural rubber, polybutadiene polymers, ethylene-propylene (EPR) rubbers, butyl rubber, ethylene-vinyl acetate copolymers, neoprene, SBR, and practically every other type of known rubbers. The sessions devoted to vulcanization touched on such subjects as the kinetics of heat curing of synthetic rubber, the activation energy of vulcanization, diffusion of S-35 in rubber, the vulcanization of EPR with peroxides, and phenol resins as curing agents.

The single testing session included papers on the modulus and resilience of polymers in gum and black-loaded states, new methods for testing vulcanizates, new abrasion studies based on the Dunlop-Lambourn principle, the relation of elastic constants of high polymer substances to temperature, and methods for cold testing high polymers. Special tire subjects included at the conference were improved tire performance with synthetic rubber, cord paths in tires, measurements of deformation with extensometers on tires during inflation and rolling, the origin of tire squeal, and the radial stiffness of pneumatic tires.

Papers given at the session on fillers included the reinforcement of natural rubber by carbon black and high energy radiation, the reinforcing effect of fillers in vulcanizates, the relation between the physical and chemical structure of silicas and the properties of rubber, the effects of lowered structure in the carbon black reinforcement of rubber, and experience with rubber containing carbon black. The session on aging featured papers on oxidative stress relaxation studies of radiation-cured vulcanizates, antiozonants in oil-plasticized rubber, the aging behavior of butyl vulcanizates, oxidation of unsaturated elastomers, and the mechanism of ozone cracking of rubber.

Technology and production were covered at the conference by papers devoted to productivity measurement in the rubber industry, helical flow in extruded goods, mechanical strength of conveyor belts in relation to defined flaws, a new economical method of producing latex foam, properties of vulcanizable systems of rubbers and thermoplastics, and new principles for calculating properties of V-belts.

Additional papers at various sessions covered such subjects as the quantitative infrared-spectroscopic determination of rubber isomers, the identification and quantitative determination of elastomers in rubber, measurements of specific and latent heat in rubber, capillary-rheometry as a method for predetermining the behavior of neoprene during processing, determination of small quantities of monomers in latex, and the effect of piperidine on rubber solutions. Still others were devoted to the variability in synthetic rubber supplies, the distribution of foreign matter in natural rubber supplies, tensile strength of styrene-butadiene-rubber vulcanizates, and influence of the thickness of test vulcanizates on the tensile strength values measured by the ASTM standard method.

Obviously, it is somewhat difficult to attempt to discuss the subject matter of 62 papers in any detail, particularly when most of the papers involved were presented in languages other than English. Even attempting to read all of these papers in original or translated form is a difficult task. Accordingly, we have made arrangements with Dr. William C. Wake, of the Research Association of British Rubber Manufacturers, Shawbury, England, to prepare a technical evaluation of the papers presented at the West Berlin meeting for the benefit of our readers. This evaluation will be published within the next few months.

Following the usual European method at technical meetings, all of the authors of papers at the DKG Congress limited their addresses to a brief report on the main essentials of their subject, aims and results. Each paper was followed by discussion and many of them resulted in fairly lengthy and detailed discussions. The session chairmen, in addi-

tion to Dr. Fromandi who presided at the opening and the plenary lectures, included the following:

O. Giese (Gummiwerke Fulda), E. Pieper (Vereinigte Glanzstoff Fabriken), C. Brunger (Continental Gummiwerke), W. Stegemann (Phoenix Gummiwerke), W. Kraemer (Deutsche Dunlop Gummi), W. Klein (Bunawerke Huls), D. Schmidt (Wirtschaftsverband der Deutschen Kautschukindustrie), H. Hellwage (Metzeler Gummiwerke), W. Scheele (Kautschukinstitut), P. Stocklin (Farbenfabriken Bayer).

Before concluding this report, it would be appropriate to add a few comments of general interest. For instance, reference has been made to the fact that facilities for meetings at the Kongresshalle were excellent. These facilities, in addition to the auditorium and lecture hall already mentioned, included a large, roomy restaurant which served good food at reasonable prices, the maintenance of a bank for exchanging foreign currencies and for cashing traveller's checks and letters of credit at the official rate of exchange, a post office counter dealing with general postal services, including telephone calls, and a travel bureau for inquiries, bookings, etc. Some of these facilities proved a boon to many of the overseas delegates. A special press room was also maintained, with complete services offered by the staff.

Unique Services

Another unique, and highly appreciated, service at the Kongresshalle was the use of the screen for memorandums to attending delegates. Numerous meetings between individuals and groups were arranged by this method, the messages spelling out specific meeting places for people who knew each other by name and correspondence only. Identification badges furnished to delegates, incidentally, were round discs of white rubber, with ample room for names to be printed in ink in the center portion.

Translations of technical material from one language to another are also difficult, and Berlin proved no exception. In general, however, the translations, furnished to delegates on request in special envelopes, in German, English and French as desired, were clear enough to follow most of the presentations. Some of the slides used in connection with papers, however, could stand considerable improvement. This, of course, is a problem at all technical meetings, whether held in West Berlin, London or New York.

Some of the slides used by the authors where excellent, not only from the standpoint of clear-cut data, but because the wording employed appeared in both German and English. One set of slides, as a matter of fact, contained German-English-French notations. This is an excellent approach where an international meeting is concerned, since it is frequently possible to grasp the data shown on slides even if one is not able to completely follow the text when presented in another language. And once again we plead with authors to refrain from using slides showing heavy tabular material on a single slide. A little thought will generally result in such data being split into two or more easy-to-read and easy-to-follow slides.

By any accepted standard the International Rubber Conference held in West Berlin was satisfactory. A good deal of new technology will be added to the available literature in due time. Every single paper presented attracted an audience large enough to justify the time and effort involved in the preparation of the material. The discussions were frequently stimulating and often led to additional "corridor conversations" which are so important to meetings of this kind. The Deutsche Kautschuk-Gesellschaft is to be congratulated on a job well done—an extremely well organized rubber conference.

Singapore Conference Rearranges Grading

► A decision to eliminate the twelve overlapping Rubber Manufacturers Association and Singapore grades and to substitute ten new international grades was made at the International Rubber Quality and Packing Conference, held in Singapore in September. Other matters agreed on were an official listing of types of rubber available in lower qualities than grades already accepted, and the setting up of an international sample committee.

It was also agreed upon that further conferences should be held every two or three years. The Rubber Manufacturers Association in the United States was appointed the permanent secretariat of international quality and packing conferences.

In connection with the grading of rubber, it had already been decided at two previous conferences that 24 internationally accepted grades would be adopted out of a total of 36 traded in volume throughout the world. Twelve grades were eliminated by the present conference due to overlapping. In explaining the move it was stated that R.M.A. Four and Five ribbed smoked sheets were related to the Singapore Four and Five ribbed smoked sheet; R.M.A. clean thick blanket crepe was related to Singapore (CCC) thick remilled blanket crepe; and R.M.A. Two, Three, and Four clean thin brown crepe were related to Singapore Two, Three, and Four thick brown remilled crepe. The new international grades agreed on as substitutes are: International Four, Five and Six ribbed smoked sheet; International Two, Three, and Four clean thick blanket crepe; International One, Two, Three and Four clean thin brown crepe.

The official listing of types available in smaller quantities than the internationally accepted grades will cover air-dried sheet, including sheet prepared with proprietary additives, skim rubber, technically classified rubber, superior processing rubber, and certain other material.

The Rubber Trade Association of New York, Inc., was represented at the Singapore meeting by H. J. Braker, vice-chairman of the Joint RMA-RTA Type Sample Committee; R. A. Badenhop, chairman of the board; J. G. Paterson, of H. A. Astlett & Co., Inc.; and R. J. Curtis of Littlejohn & Co., Inc. In addition to Mr. Badenhop and Mr. Paterson, R. D. Reilly of Imperial Commodities Corp. joined the U. S. delegation attending the International Rubber Study Group in Kuala Lumpur.

The chairman of the September 19 I.R.S.G. meeting in Kuala Lumpur was the Minister for Commerce and Industry, Inche Mohamed Khir Johari, and the welcoming address was delivered by the Prime Minister, Tunku Abdul Rahman Putra. Also in attendance was the deputy Prime Minister, Tunku Abdul Razak.

► Hooker Chemical Corp., Niagara Falls, N. Y., has issued an appointment calendar which includes a listing of all the company's offices.

Elected by N.J. Zinc

► James R. Alexander has been elected vice-president in charge of sales by New Jersey Zinc Co., New York, N. Y., succeeding Robert G. Kenly who will assume new administrative duties. Mr. Alexander is a graduate of Kenyon College and has had over 20 years' experience in sales work. He started his career in the sales organization of the Glidden Co., in Cleveland, Ohio. He became a sales representative for Quaker Rubber Co. in 1944, and when that company was acquired by H. K. Porter Co. in 1949, he was named district manager for the Cleveland and Detroit areas. In 1952 he was named general sales manager, and he was elected vice-president of sales of the Thermoid Division of Porter in 1958.

Powdered Polyethylene

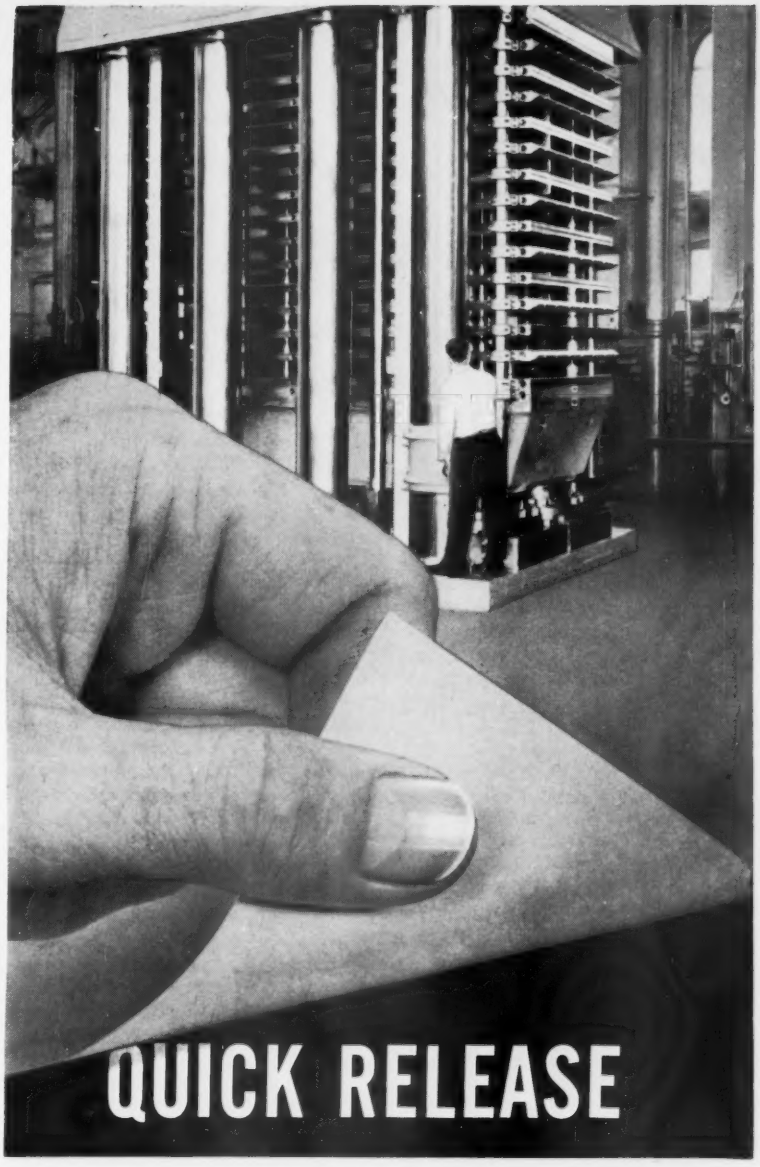
► U. S. Industrial Chemicals Co., New York, N. Y., a division of National Distillers & Chemical Corp., has started marketing powdered polyethylene plastic and expects to start pilot plant production of the powder in March, 1960. According to the company, the powdered polyethylene can be used as textile coating, drum linings and specialized paper coatings. The pilot plant, located in Tuscola, Ill., is expected to have an initial capacity of two million pounds of the powdered plastic a year. The process to produce the powdered polyethylene plastic is licensed from a Swiss firm, the company reports.

U.S. Rubber to Build

► The Naugatuck Chemical Division of the U. S. Rubber Co., New York, N. Y. has announced that it will construct a $2 million pilot plant in Baton Rouge, La., for trial production of stereo regulars. Engineering is nearly completed. Construction will start this year, and the plant is due for completion in the fall of next year. Multi-ton batches of the new rubbers will be produced in the new unit for further evaluation in tires and other basic productions.

Acquires Full Ownership

► National-Standard Co., Niles, Mich., has increased its ownership of the National Standard Co., Ltd., Kidderminster, England, to 100 per cent. Prior to this, the American firm owned 78.5 per cent of the English subsidiary. The accounts of the English company will be consolidated into the parent company's statement for the first time this year.



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Natural Rubber Conference Stresses Research Picture

► Over 250 delegates from all parts of the world attended the Natural Rubber Research Conference at the headquarters of the Rubber Research Institute of Malaya, Kuala Lumpur, from September 26 to October 1. The conference, designed to stress the Malayan natural rubber industry's expanded research and development program directed at producing a better product that can be marketed at the lowest possible price, featured 76 papers presented by scientists and technologists from research organizations, commercial firms and rubber institutes from many different countries.

Of the two concurrent sessions, Session One covered research on the production of Natural Rubber, and Session Two, research on the preparation and use of natural rubber and latex. The conference was jointly sponsored by the Federal Government of Malaya and the Rubber Producers' Council, and was formally opened by Malaya's Minister of Commerce and Industry, Inche Mohamed Khir Bin Johari. Among the highlights of the conference were guest addresses by Professor James Bonner of California Institute of Technology; Professor G. E. Blackman, F.R.S. of Oxford University; and Professor Geoffrey Gee of Manchester University.

In opening the conference, the Honorable Inche Mohamed Khir Bin Johari, stressed the competitive position in which natural rubber now finds itself:

"Both the government and the industry have confidence in the future of natural rubber, and large sums of money are being invested in research and extension services and in various schemes to encourage estates and small holders to replant with modern high-yielding material. I need hardly emphasize the importance we attach to the necessity to equip our rubber producers with the means to compete successfully with the synthetic producers, and that not only must there be an intensification of our research efforts, but also a proper coordination of our research work. It is with this objective in mind that the Natural Rubber Research Conference of 1960 has been organized."

Sir Geoffrey Clay, controller of Rubber Research and chairman of the Malayan Rubber Fund Board, was chairman for the opening session on Tuesday, September 27, and the address of welcome was delivered by C. G. Akhurst, acting director, Rubber Research Institute of Malaya. In his speech Mr. Akhurst cited statistics of the impressive response to the Natural Rubber Research Conference. About 300 were in attendance, and over 70 papers were submitted. About 20 different countries were represented, said Mr. Akhurst, including a number from Europe, Africa, India, Ceylon, the Far East, Australia, and the United States. The speaker briefly called to mind the history of the Rubber Research Institute, and then went on to his main point, the future:

Expanding Markets

"The basic intentions and motives behind our program of work are founded on an over-all picture of an expanding world market for all forms of rubber—both natural and synthetic—and if this forecast is confirmed through the coming 5 to 10 years, it will be the fundamental intention of the natural rubber industry to see that the definite share, or percentage, that natural rubber already has in world markets is at least maintained and if possible improved.

"Our research effort must be the strongest possible one if these ends are to be attained, and particularly in face of the intensive research which the synthetic rubber industry is undertaking for exactly opposite reasons." The speaker stressed the need for concentration of natural rubber research on cost and quality, so that the industry could compete within the production costs of synthetic rubber, and also "to maintain and improve the quality of natural rubber, including the preparation of new and different rubbers which will be at least as attractive to the consumer as synthetic products. . . " He also pointed to the need for developing new end uses in developing his theme of the future for natural rubber.

The first guest speaker was Professor James Bonner, head of the Divison of Biology, California Institute of Technology, currently engaged in plant physiological research, and noted for his investigations of the biochemical production of rubber in the plant system. Professor Bonner delivered a paper on "The Biogenesis of Rubber." The chairman was Inche Salim bin Mohamed Akib, chairman of the Boards of Administrators of the Government Rubber Replanting Schemes, Federation of Malaya.

The next guest address was given Wednesday, September 28, by Professor G. E. Blackman, Sibthorpian Professor of Rural Economy at Oxford University and director of the Agricultural Research Council, Unit of Experimental Agronomy, on "The Stimulation of Latex Flow by Plant Growth Regulators." Chairman at this time was Professor G. E. Maxwell Davies, Department of Agriculture, University of Malaya in Kuala Lumpur. In his paper Professor Blackman gave an analysis of all the work done in various countries on the application of various substances to plants to regulate their growth, in which rapid advances have been made. He dealt in particular with application of such regulators to the rubber tree to stimulate the latex yield starting with an experiment in 1939 in which the "application of palm oil with light scraping below the tapping cut induced an increased yield of latex." He went on to mention how, in one method a large increase in yield had been obtained by applying a hormone known as 2,4-D to scraped bark below the tapping cut.

In closing Professor Blackman said "There is no gain-saying the great economic advantage that has accrued since 2,4-D and 2,4,5-T have been widely applied in plantation practice. In this connection the Rubber Research Institute has made some enquiries about the annual consumption of the prelimanary proprietary formulations in Malaya. Over the four years the amount sold reached 171,000 gallons. One gallon is sufficient to treat 200 trees twice yearly at the recommended rates and there will be about this number of trees per two acres." As for the re-

sults achieved he added "a mean gain of 200 lb. per acre is a conservative figure."

He continued, "Thus, the total additional yield over the same period can be estimated at 68.4 million pounds. Converting this extra production into monetary terms, on the basis of the average price of rubber in each year the total is no less than 63 million Straits dollars or 7.4 millions sterling." Even if one were extra cautious and halved the totals, and allowed for wastage "this is still a very handsome return for the money spent on research."

On Friday, September 30, Professor Geoffrey Gee, Sir Samuel Hall Professor of Chemistry, University of Manchester, spoke on "New Methods of Elastomer Synthesis and Their Impact on Natural Rubber," stressing his point that "natural rubber can hold its place—in the expanding market for elastomers—as one of a range, each with its own special function for the consumer," and dwelling on "the striking results made possible by the blending of natural and synthetic." The chairman was Dato Gunn Lay Teck.

Inche Abdul Jalil Bin Haji Aminuddin, chairman of the Rubber Producers' Council of the Federation of Malaya, was to have been chairman of the closing session, but was unable to attend due to illness in his family, and the chairman's introductory remarks were given by Mr. Akhurst in his absence. Mr. Akhurst, introduced Sir Geoffrey Clay, controller of Rubber Research and chairman of the Malayan Rubber Fund Board.

Natural Rubber Research

Sir Geoffrey, in his address on "Natural Rubber Research" underlined the importance of the many papers and views which had been presented at the conference and went on to say ". . . I cannot escape the conclusion that the developments in the management of the tree, including such items as yield stimulants, nutritional requirements of the high-yielding rubber trees, tapping systems, the reproduction and development of new clones and new varities, the relation between the clonal stocks and the clonal scions, the phenomena of wind breakage, and dry trees, these and many other aspects of research on the crop, are so obviously bound up with the physiology of the rubber tree, that I believe a review by a high level plant physiologist of the physiological work being carried out in several divisions of the Rubber Research Institute would be worthwhile as a project . . ."

In speaking of the product itself, he added, ". . . I cannot help feeling that research on the product, aimed at producing modified natural rubbers for particular purposes, possibly associated with the blending of natural and synthetic rubbers for particular end uses, must be a major consideration in the policy on research into the product." He stressed intensification of the Technical Advistory Services so that the results of research could be applied as standard practice. Sir Geoffrey concluded his address by expressing his belief in the future of the natural product.

The conference was closed by The Honorable Inche Cheah Theam Swee, Assistant Minister of Commerce and Industry, Federation of Malaya, who, in summing up the importance of the conference said: "There can be no doubt that the Conference has achieved its declared objects. Unlike previous conferences on natural rubber in which either the production or the technology of the product has been particularly stressed, the Conference has dealt with both aspects in a very full manner. One happy result of this has been the opportunties for chemists to mingle with agronomists, and rubber technologists with botanists. I feel sure that as a result the respective

R. O. Babbit

O. B. Samler

Vanderbilt Reassigns Two

► R. T. Vanderbilt Co., New York, N.Y., has announced that O. B. Samler has been transferred to the Vanderbilt Export Corp., also of New York, where he will serve as manager. R. O. Babbit has been transferred to the New York office of the R. T. Vanderbilt Co., where he will assume the technical sales and service activities formerly handled by Mr. Samler. Mr. Samler obtained a B.S. degree from Pennsylvania University and a M.S. degree from Syracuse University. His experience in the rubber industry includes two years of compounding at Goodrich; three years at the Vanderbilt laboratory at East Norwalk, Conn.; two years as a technical sales representative, and four years in administrative sales in the New York offices of R. T. Vanderbilt. He is a member of A.C.S. and S.P.E.

Previous to his new appointment, Mr. Babbit was a technical sales representative for the company in the U.S. and Canada for some twenty years. For five years before that, he worked at the East Norwalk laboratory. Mr. Babbit has also been associated with Latex Fiber Industries. He obtained his B.S. degree at St. Lawrence University and is a member of A.C.S.

research workers have a better appreciation of each other's problems."

The closing session of the Conference was also addressed by R. M. E. Michaux, vice-president, de l'Union des Planteurs de Caoutchouc, and chairman, International Rubber Research and Development Board, and R. de Padirac, Secretaire General de l'Institut Francais du Caoutchouc, who anounced another Rubber Research Conference, to take place in Paris in May 1962.

Chairmen and the various sessions they presided over were: M. P. Compagnon, directeur des recherches, Instituts des Recherches sur le Caoutchouc au Vietnam et au Cambodge, Nutrition I; W. G. Wren, head of the Chemical Division, Rubber Research Institute of Malaya, Chemistry and Technology of Dry Rubber I; E. A. Rosenquist, director of research, Chemara Research Station, Seremban, Nutrition II; Geoffrey Gee, Sir Samuel Hall professor of chemistry, University of Manchester, Chemistry and Technology of Dry Rubber II; Dr. E. D. C. Baptiste, director, Rubber Research Institute of Ceylon, Tapping: Yield Stimulation I; M. R. Hublin, directeur des recherches, Institut Francais du Caoutchouc, Chemistry and Technology of Latex; J. S. Ure, acting director of agriculture, Federation of Malaya, Tapping: Yield Stimulation II; Dr. L. Bateman, director of research, Natural Rubber Producers' Research Association, Chemistry and Technology of Latex II; Prof. M. E. D. Poore, Department of Botany, University of Malaya in Kuala Lumpur.

Prof. J. Bonner, Division of Biology, California Institute of Technology, Biochemistry of Latex I; C. E. T. Mann, lately director, Rubber Research Institute of Malaya, Breeding and Selection: Vegetative Propagation I; Dr. G. C. Cockbain, Natural Rubber Producers' Research Association, Biochemistry of Latex II; Ir A. Garot, agricultural director, Research Institute for Plantation Crops, Indonesia Breeding and Selection: Vegetative Propagation II; H. M. Collier, research director, Dunlop Research Centre, Batang Malaka; Microbiology of Latex II; A. Johnston, F.A.O. Regional Office, Bangkok, Pest and Diseases II; J. H. Pidford, general manager, H & C Latex Ltd., Malaya, Factory Practice and Allied Subjects.

A special stamp commemorating the 15th Meeting of the International Rubber Study Group and the Natural Rubber Research Conference, was issued by the Federation of Malaya, showing a Hevea Brasiliensis seedling.

H. C. Crosland

Joins Chemical Rubber

► Howard C. Crosland, formerly with Chicago Rawhide Manufacturing Co., Chicago, Ill., has joined Chemical Rubber Products, Inc., Beacon, N. Y., as vice-president. In his new post he will manage all phases of finished parts production, both molded and cut, from the company's coated fabrics and sheet stock. Mr. Crosland graduated from the University of Wisconsin with a B.S. degree in chemical engineering in 1939, and joined National Starch Products in New York, N. Y. In 1942 he became associated with Chicago Rawhide, and in 1953 he became technical director of the company's Synthetic Rubber Division. He was transferred to the company's plant in Elgin, Ill., in 1959, and became manager of the Plastics Department.

Merger Report 'Untimely'

► A. A. Garthwiate, Jr., president of Lee Rubber and Tire Corp., Conshohocken, Penna., has termed recent reports of merger discussion between Lee and Mohawk Rubber Co. "untimely and premature." He stated that the talks with Mohawk were purely exploratory to see if the joining of the two firms would provide a broader base of operations, and that further discussions with Mohawk are not contemplated at this time.

Buffalo Hears About The Future of Rubber

► "An Appraisal of the Outlook for U. S. Rubber Consumption" was the subject of a talk presented by W. C. Douce (Phillips Chemical) and J. W. Loy (Phillips Petroleum) before 110 members of the Buffalo Rubber Group at its Fall Meeting on October 11 at the Continental Inn Hotel in Buffalo, N. Y. Mr. Douce, who delivered the talk, stated that the relationship of new rubber consumption in the United States to personal consumption expenditures promises continued growth over the long term. He pointed out that rubber goods represent a highly essential commodity in our economy and one not likely to be replaced or outmoded in the foreseeable future.

He explained that many existing types of synthetic rubbers are firmly entrenched in the market, being reliable in performance and low in price. According to Mr. Douce, research and capitalized technology, however, will continue to bring forth improved or wholly new compositions. He explained that chief among these for the time being is the category of synthetic replacements for natural rubber. He remarked that substantial production capacity in this classification already is assured for the near future.

Bullard Clark Builds

► The Bullard Clark Co., Danielson, Conn. is constructing a new plant, to be a branch of Jacobs Rubber Division, for the production of mechanical rubber goods. The site is located in Dayville and comprises 39 acres, allowing room for expansion of the original 30,000 square foot plant up to 100,000 square feet. The pre-engineered building will be an aluminum-sided structure, sand colored, with readily movable walls. The site is part of an area designated as an industrial park by the Connecticut Development Commission.

Vote Financial Aid

► In a special election, voters in Batesville, Ark., have approved tax and bond measures that permit the city of Batesville to aid in financing a new plant to be constructed by the Seiberling Rubber Co., Akron, Ohio. The new plant will produce additional shoe products and other rubber goods now being manufactured at full capacity at Seiberling's plants in Barberton and Carey, Ohio.

Rubber Display Part Of Automobile Show

► A rubber industry exhibit keyed to the theme "Wheels of Freedom Roll on Rubber," was a highlight of the 43rd National Automobile Show held October 12-23 at Cobo Hall in Detroit, Mich. The exhibit was part of the Auto Wonderland "side show" to the auto show, and the rubber industry joined some 100 other suppliers in demonstrating their services to the automobile industry.

Rubber had its place in a section of Auto Wonderland devoted to the raw materials and components used by the automobile industry. The rubber exhibit covered all phases of the tire and non-tire automotive rubber product lines. Visitors entering the rubber display were greeted by a stainless steel panel displaying five wheels mounted with original equipment tires and with hub caps identifying cars of each of the automobile manufacturing companies—the display entitled "The Rubber Industry Salutes Automobile Manufacturers."

From this, visitors moved on to an illuminated panel portraying the history and growth of the use of rubber components in autos, and then into a "tunnel" museum where more than 500 automotive rubber parts were exhibited with vari-colored lights. A continuous taped narrative described the part these components play in terms of automotive safety, service, comfort and convenience.

Emerging from the "tunnel," visitors encountered a panel portraying on one side the skeleton of a car done in colored rubber, illustrating use of rubber components; and on the reverse side the story of man-made rubber. Adjoining this was a diorama covering natural rubber production, the manufacture of synthetic rubber, and the processing of the raw materials into end products.

A major feature of the exhibit was the tire building center, an operational display. The final display, under a large circular plexi-glass dome, enabled visitors to trace the movement of crude rubber from ships, across the docks, to the plants, through processing, finishing and inspection, and to the consumer channels of trade.

Rubber Manufacturers Association Secretary George Flint and Public Relations Director Charles C. Miller examine one of the six "A" panels of a display on the automotive uses of all types of hose at the 1960 National Auto Show.

At the National Auto Show, George Austin, left, shows Rubber Manufacturers Association President Ross R. Ormsby a display on how the first of four bias-cut, rubber-coated fabric plies is applied to a collapsible rim tire building drum.

Ward to Head Olympic

► Robert W. Ward has been named president of the newly organized Olympic Chemical Co., Greensboro, N.C., producers of polyurethane foam for the furniture, textile and rug industries. Other officers are: Sydney M. Cone, Jr., *vice-president;* Harold W. Smith, *secretary-treasurer;* and Alan W. Cone, *assistant secretary*. Lester W. Bates has been named manager of the company's plant, which employs between 25 and 30 persons.

Mr. Ward holds B.S. and M.S. degrees in chemical engineering from Columbia University, New York, N.Y. He has been associated with the American Cyanamid Co., New York, N.Y., and Reynolds Plastics Co., Walled Lake, Mich. He served as head of the Engineering Department of Nopco Chemical Co., Newark, N.J., until 1955, when he went to Germany to investigate the polyurethane industry. Upon his return he was made production manager of Nopco Plastics Division.

Mr. Bates holds a B.A. degree in chemistry from the University of Buffalo, N.Y., and has done post graduate work in plastics and rubber technology. He has been research supervisor for Hewitt-Robins, Inc., Franklin, N.J., for the past six years.

Celanese Ups Capacity

► Celanese Corp. of America, New York, N. Y., has announced plans to almost double its facilities at Pampa, Texas, to an added production capacity of 14 million pounds of acrylate chemicals annually. Among the newer acrylate chemicals the company plans to make at Pampa are butyl acrylate, acrylic acid and 2-ethylhexyl acrylate.

ASME Rubber Division Holds October Meeting

► The first conference of the Rubber and Plastics Division of the American Society of Mechanical Engineers to be held independently of the parent society was held on October 9 to 11 at the Hotel Lawrence in Erie, Penna. The conference was attended by over 200 persons and consisted of three rubber and three plastics sessions at which 26 papers were presented—14 in the rubber sessions and 12 in the plastics sessions. George H. Billman (Lord Mfg.) served as general chairman of the conference, and A. G. Gifford was vice-chairman. A luncheon was held on Monday, October 10, at which the guest speaker was Dr. Turner Alfrey (Dow Chemical) who spoke on "Theory and Experiments in the Mechanical Processing of Plastics."

Serving as chairmen of the rubber sessions were: G. L. Bruggemeier (Firestone); Emil H. Krismann (DuPont); and Graham Morbey (Dunlop Research). Chairmen of the plastics sessions were: Chester Ward (Molded Fiberglass); H. F. Wakefield (Union Carbide Plastics); and R. C. Burck (Mobay Chemical).

Rutzler Succumbs

One note of sadness occurred during the conference when Dr. John E. Rutzler (Case Institute) died of a heart attack minutes after he concluded his presentation at a plastics session on Monday afternoon, October 10.

Papers presented at the plastics session included: "Novel Designs in Sandwich Structures," by Andrew C. Marshall (Hexcel Products); "New Apparatus for Study of Mechanical and Electrical Properties of Plastics," by Selby M. Skinner (Westinghouse) and Edward L. Kern (Wright-Patterson AFB); "A New Viscoelastic Compound for the Suppression of Noise and Vibration in Structures," by Charles H. Peterson (Hughson Chemical).

"Reinforced Plastic Films as an Engineering Material," by Johan Bjorksten (Bjorksten Research Laboratories) and William Cameron (Griffolyn Co.); "Plastic Pipe for Industry and the Home," by L. L. Loudin, Jr. (Marbon Chemical); "Air Structures—A New Concept in Engineering Design," by Walter W. Bird (Birdair Structures).

"Thermoforming — Its Process and Applications," by J. R. Lynch (Dow Chemical); "Fillers and Stresses in an Epoxy Resin," by John E. Rutzler, Jr. and Leonard C. Feinstein (Case Institute); "Stress-Strain Relations in Cross-Linked Polyethylene," by I. L. Hopkins and R. P. Wentz (Bell Telephone Laboratories).

"Design Strength Data and Calculations on Thermoplastics," by W. D. Harris (Dow Chemical); "Obtaining Stress-Per Cent Compression Diagrams of Foamed Plastics at High Rates of Compression," by R. C. Dove, W. E. Baker (University of New Mexico) and C. D. Beaman (Creole Petroleum); and "Annual Review of Engineering Developments in the Plastics Industry, 1959-1960," by G. B. Jackson, H. G. Dikeman, and K. R. Nickolls (Monsanto Chemical).

Abstracts of the 14 papers presented at the three rubber sessions follow:

Abstracts of Papers

Principles of Processing Liquid Urethane Elastomers, by J. A. Hanzel (DuPont). The technical merit of the liquid urethane elastomers is well established. Their exceptional combination of physical properties qualifies them for many uses which fall somewhat outside the range of more conventional elastomers. Liquid urethane processing involves mixing a liquid urethane polymer and fluid curing agent. The mixture is discharged at atmospheric pressure into a mold and oven cured without pressure to form a finished molded product. Several urethane polymers in combination with various curing agents provide a series of products representing a broad range of vulcanizate physical properties. Liquid urethane polymers are basically the reaction of products of a diisocyanate and a polymeric polyether or polyester glycol. The Adiprene L urethane rubber family of polyether based polymers will be used as the reference polymers in this paper.

Presses in the Rubber and Plastics Industry, by Everett Perlberg (Adamson United). Recognizing some of the problems inherent in press design as a result of extreme accuracy of processing rubber and plastics, this paper discusses a number of the features which can be incorporated in presses to improve their operating efficiency and to produce more accurate parts. The paper deals exclusively with compression and transfer type presses, bearing in mind that virtually all of this type of equipment is subject to problems of thermal expansion, and some to problems of alternate heating and cooling cycles.

Automated Tire Curing Room, by L. E. Soderquist (McNeil Machine & Engineering). In 1950 the Bag-O-Matic method of curing became an accepted means of curing tires in the rubber industry. This method uses a curing diaphragm which is mounted on rings and remains in place in the curing press from one cure to the next. This paper describes the various ways of applying automation to this method of tire curing. The automatic and semi-automatic handling of passenger and truck tires in the curing room and the resulting advantages, is covered in detail. This paper also deals with automatic post inflation as the tire leaves the curing press.

Magnetic Rubber, A New and Useful Material, by Robert J. Webster (Denman Rubber). Recently, a new and unique material became available which provides another tool for use by engineers in designing machines and systems to handle metal strips, shapes, and objects. The paper deals with this new material, a flexible, magnetic rubber, and describes characteristics of the material, its present general status in industrial, electronic, and novelty fields, its method of manufacture, and its possibilities and applications with emphasis on its use as roll covering in steel, steel strip, and metal-handling systems.

The Analog Computer and its Application in the Rubber and Plastics Industry, by Adolph Katz and Paul Berthiaume (Electronic Associates). The general purpose analog computer is a modern engineering tool, which can be used effectively for the design, synthesis, and analysis of physical systems. By connecting a series of operational blocks, which comprise the analog computer, in an arrangement satisfying the postulated relationships of a physical or mathematical system, a model of that system is obtained. Experiments can then be conducted with the model to determine appropriate parameters for high stability and performance and to establish the critical parameters and their sensitivity on the response of the system. The authors define the general nature of the components available in the computer as well as basic programming procedures to model the physical or mathematical systems of interest. This is followed by a description of typical applications in the rubber and plastics industry.

An Introduction to Biaxial Stress Problems in Fabric Structures, by A. D. Topping (Goodyear Aircraft). The reasons for the increasing interest in fabrics as structural materials are discussed, and the superiority of fabric to isotropic sheet and films in tear resistance is given an analytical basis. The shearing stiffness of single-ply fabrics is investigated and

found to be a function of the stress level and of the boundary conditions. Two important special cases are analyzed, both of which yield the result that the stiffness is equal to the stress in one set of threads.

Expandable Structures for Space, by J. T. Harris (Goodyear Aircraft). The purpose of this paper is to demonstrate the applicability of inflated expandable structures to astronautics and indicate how this approach can accelerate current efforts to adapt our space environment to useful scientific purposes. An inflated expandable structure is defined as one constructed of flexible materials which can be packaged into a small volume and, upon command, be expanded into its designed shape through the media of inflation.

Elastomers as a Structural Material, by E. E. Thielker (DuPont). A general discussion is presented on the use of elastomers in structural applications. The distortion and recovery of elastomers are unique characteristics which are essential in damping vibration. "Floating" rooms resting on elastomer mounts have become a necessity to protect sensitive equipment to meet the exactness required in precision testing and experimentation. Modern structural applications, some very unique, indicate the variety of uses to which elastomers can be put to meet exacting tolerances.

Planning and Design Requirements for the Handling of Collapsible Rubber Containers, by Neuberne H. Brown, Jr. (O-T-D Container Corp.). Annually millions of tons of both liquid and dry products are handled in bulk transportation equipment instead of the former bags, boxes, and drums. This change is but a segment in the over-all industrial approach to the increase of man-hour productivity termed automation. This paper pertains to those commodities requiring protection and special conveying, transportation, and storage facilities. Sugar, starch, flour, plastic resins are typical of materials in this category.

Dracone Flexible Barges — Some Problems of Design, Materials and Construction, by H. Warburton Hall (Ministry of Supply, London). The ideas leading to the development of flexible barges for transport of lightweight liquid cargoes are outlined. The results of detailed theoretical and experimental studies of shape and towing stability and drag, operational stresses and strength requirements, properties of the materials of construction (rubber-proofed fabrics) and methods of construction are summarized and illustrated with graphs and photographs.

Elastomers Applied to Structural Damping, by Bruce W. Campbell (Lord Mfg.). Sonically induced fatigue can be reduced by increasing the strength of conventional designs to carry the additional dynamic loads. Resonant and transient response of many mechanical systems have been controlled by the addition of damping in the design. Since sonic fatigue is a resonant problem, it is obvious that damping added to the system will reduce dynamic stresses and hence increase fatigue life. Present-day damping treatments involve the addition of materials with viscoelastic properties to existing structural designs. These are discussed in the paper.

(continued on next page)

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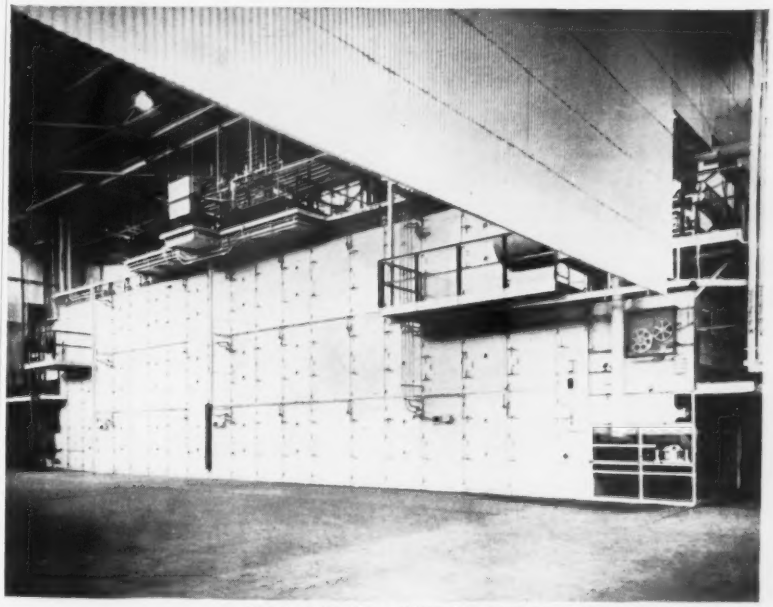

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Automotive Engine Mount Design, by A. L. Everitt (Inland Mfg.). Any engine mount is an important key part in any automotive structure. Functionally, a mount can be described as follows: (1) It is a basic structural member. (2) Its overall functions must be keyed with the suspension, frame, body, transmission, and final drive. (3) The whole package, properly allied, provides the quiet, comfortable car of today. A brief resume of the engine mount's companion parts is outlined in the paper.

Elastomeric Gyro Suspensions, by James T. Gwinn, Jr. (Lord Mfg.). "Black boxes" with fragile gyros inside them usually require protection from environmental shock and vibration. To obtain this protection, resilient suspension systems are used. Although the use of such systems may create other problems, particularly where gyros are concerned, the benefits possible through the use of a properly designed suspension far outweigh the disadvantages. A very efficient type of suspension system may be obtained by using mountings which utilize highly damped elastomer as the resilient member. Through the use of special elastomer formulations, the combined advantages of mechanical simplicity, silent operation, inherent material damping, high isolation efficiency, and constant performance over broad temperature ranges may be realized for various types of suspension figurations.

Plastic Films Continuously Laminated to Rigid and Semi-Rigid Substrates, by D. M. Wilkinson (C. A. Litzler). The paper describes the continuous application of plastic films to discontinuous or continuous substrates for horizontal or vertical applications, either decorative or functional. It describes the applications of both supported and unsupported films either clear, printed, or opaque and also covers the adhesive system and subsequent processing to be used for each combination.

IRC Manual Available

► The Proceedings Manual of the November 1959 International Rubber Conference has been made available. The manual is a 613 page paperbound volume of all the papers presented at the International Rubber Conference held in Washington, D. C., in November, 1959. Copies may be obtained from the Treasurer, Division of Rubber Chemistry, American Chemical Society, c/o Harwick Standard Chemical Co., 60 S. Seiberling Street, Akron 5, Ohio. The price, to members and associates of the division, is $10.00 per copy; to non-members, $12.50 per copy.

► A new catalog showing its 1960 line of fire equipment has been issued by Ansul Chemical Co., Marinette, Wisc. Listed is Ansul's complete line, including hand portable extinguishers, stationary fire equipment, piped systems and large capacity mobile equipment.

Thomas A. Galvin

Named Plant Manager

► U. S. Rubber Reclaiming Co., Inc., has named Thomas A. Galvin manager of its new Vicksburg, Miss., plant, which is nearing completion. An engineering graduate of the U. S. Merchant Marine Academy, Mr. Galvin has held engineering posts in industry since 1946. Before his new appointment, he was plant engineer of the company's main production facilities in Buffalo, N. Y.

Promoted at Jasper

► James E. Ingram and Dana D. Hazen have both been named vice-presidents and elected to the board of directors of the Jasper Rubber Co., Jasper, Ga. Mr. Ingram, who was formerly factory manager for the company, has assumed the post of vice-president and general manager. Dana D. Hazen, who has been with the Sales Department of the parent firm, Stalwart Rubber Co., for the last 16 years, has been named vice-president in charge of customer relations for Jasper, and has moved to Jasper, Ga., to assume his duties there.

New Petro-Tex Plant

► Petro-Tex Chemical Corp., Houston, Tex., has developed a new process for production of maleic anhydride from low-cost C_4 hydrocarbons as a starting raw material and has let a contract for a 30 million pound per year plant for production. The multi-million dollar plant will be built within the Petro-Tex plant complex at Houston, using its feedstock streams, utilities, and services. Completion of the plant is scheduled for mid-1961.

Polymer Lecture Program

► The Akron Polymer Lecture Group, under the auspices of the University of Akron, Akron, Ohio, has announced its 1960-1961 program of lectures. The program follows:

November 4, "Effect of Oxygen on Vulcanized Rubber," by Dr. E. M. Bevilacqua (U. S. Rubber); *December 2*, "Single Crystals and Folding of Macromolecules," by Dr. W. O. Statton (DuPont); *January 6, 1961*, "Application of Differential Thermal Analysis to High Polymers," by Dr. Bacon Ke (Standard Oil Co. of Indiana); *February 3*, "Some Aspects of Anionic Polymerizations," by Prof. M. Szwarc (N. Y. State College of Forestry);

March 3, "Thermal Decomposition of Unsaturated Materials," by Prof. W. J. Bailey (University of Maryland); *April 14*, "Nuclear Magnetic Resonance and the Stereochemistry of Polymer Chains," by Dr. F. A. Bovey (Minnesota Mining); and *May 5*, "Polymerization by Oxidative Coupling," by Dr. A. S. Hay (G-E).

Argentine Rubber Group

► A group of Argentine rubber technologists have joined together to form the Instituto Argentino de Elastomeros, Buenos Aires, a technical rubber organization. The purposes will be: to promote the knowledge of rubber science and technology; to promote technological development and scientific research; to establish connections with similar institutions and to collaborate with national and foreign standardization institutes; to promote the training of technologists and scientists by collaborating with universities, polytechnics and, or through, its own training courses; and to promote the ethics in the rubber trade through the development of quality consciousness.

Clevite Plant Expansion

► The board of directors of Clevite Harris Products, Cleveland, Ohio, has approved a 50 per cent expansion of the company's Milan, Ohio, plant. An addition of 27,000 square feet of manufacturing space will be constructed along the north side of the present plant, which already has 55,000 square feet of manufacturing space. The addition is the first phase of a projected three-year expansion program.

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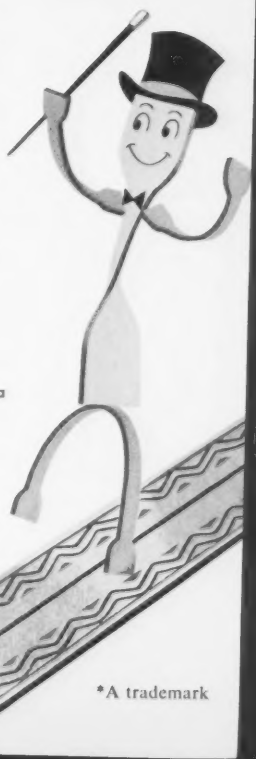

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Philprene 1018—Hot, non-pigmented, cross-linked, specially processed for low water absorption. Use with other polymers for wire and cable stocks, calendered sheet goods, footwear, extruded and molded mechanical goods.

Philprene 1019—Hot, non-pigmented, specially processed for low water absorption. For wire and cable jackets and electrical goods.

Philprene 1502—Cold, non-pigmented. For white wall tires, sporting goods, hospital goods, micro-cellular and sponge shoe soles, other light-colored items.

Philprene 1503—Cold, non-pigmented, specially processed for low water absorption. For wire and cable stocks, other electrical goods, gaskets and certain hard rubber products.

Philprene 1603—Cold, pigmented. For black tire sidewalls, molded products, footwear, tire and color applications.

Philprene 1605—Cold, pigmented. For calendered, extruded and molded goods, for good physical properties and easy processing.

Philprene 1703—Cold, oil-extended. For tires, tread rubber, mechanical goods, shoe soles and heels, floor tile and other light-colored items.

Philprene 1708—Cold, oil-extended. For tires, shoe soles, floor tiles, toys, sporting goods, mechanical goods and certain wire insulation stocks.

Philprene 1805—Cold, oil-extended, pigmented. For tread rubber stocks and mechanical goods. Exceptional flexibility in compounding.

Philprene 6701—Hot, non-pigmented. For chemically blown sponge. Easy processing. Lightest color for added compounding flexibility.

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Philprene 1608—Cold, oil-extended, pigmented. For premium-level quality tread stock and retreads. Dispersant free—produced by Philjet process.

Philprene 1609—Cold, oil-extended, pigmented. For super-level quality tread stock and retreads, for most mileage and least cracking. Highest quality pigmented rubber.

Philprene 1712—Cold, oil-extended. Used extensively in tires, tread rubber and mechanical goods.

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Fort Wayne Group Hears Ford and Emmett

► Carbon black was the subject for the first meeting of the 1960-1961 season of the Fort Wayne Rubber & Plastics Group, held on September 22 at the Van Orman Hotel in Fort Wayne, Ind., with 158 members present. W. E. Ford (Columbian Carbon) spoke on "A New Concept in Carbon Black," and R. A. Emmett (Columbian Carbon) discussed "Carbon Black as a Reinforcing Pigment." Mr. Ford pointed out that there were two major considerations that prompted the development of low structure, low modulus carbons. First, automobile manufacturers had been urging the original equipment tire companies to improve noise and ride properties without sacrificing wear, and second, channel carbons have long been of major importance to industrial rubber goods and tire producers alike.

The speaker explained that channel carbons are made from increasingly more costly natural gas and therefore a lower structure furnace black replacement was needed to maintain compound costs at a low level. According to Mr. Ford, these two problems were resolved by producing low structure oil furnace carbons which are in the HAF, ISAF, and SAF fineness range.

Cites Advantages

Mr. Ford explained to the group that the advantages of these low structure carbons to the mechanical goods compounder are: (1) A replacement for channel carbons at a lower cost. The low structure HAF produces physical data similar to channel with the exception of cure rate. The cure rate of these new low structure carbons is similar to other oil furnace blacks. (2) Because of the high resiliance, low heat buildup, and the better tensile as obtained through black rubber, it is possible to improve the quality of compounds at no extra cost. (3) The low Shore hardness and low viscosity should permit increased carbon loadings at required hardness levels. This, in turn, should open the way to lower compounding costs.

The next speaker, Mr. Emmett, said that carbon black pigments for reinforcing rubber are produced by the channel, furnace and or thermal processes. He pointed out that the basic properties of the carbon products manufactured by these methods which contribute to rubber reinforcement are: (1) fineness of particle size; (2) structure (chaining up tendency of carbons); and (3) surface chemistry. According to Mr. Emmett, by plotting the specific surface derived from fineness of particle size against oil absorption, structure index isotherms can be drawn and areas located for the various types of carbons (such as HAF, ISAF, and SAF) on a dimensional classification chart.

Mr. Emmett explained that tear resistance as an indication of reinforcement generally is increased as finer particle size carbons are used, and hot tear is generally improved through the use of fine particle size structure carbons. Abrasion resistance, he stated, as another criterion of reinforcement generally follows the same trends as indicated with tear resistance, with fineness being the dominant contributing factor being supplemented by structure particularly in SBR rubber.

To Represent Alpine

► Harwick Standard Chemical Co., Akron, Ohio, has been appointed by Alpine Aromatics, Inc., Metuchen, N.J., to distribute the company's Aldor line of deodorants and scents to the rubber and plastic industries.

Seiberling Carbo-Kwik

► A new, premium fast cure, cold rubber retreading stock, called Carbo-Kwik, has been added to the line of repair materials produced by Seiberling Rubber Co., Akron, Ohio. According to Seiberling, Carbo-Kwik represents its recognition of the tremendous challenge being created by the rapid growth of the retreading industry. Carbo-Kwik will reduce curing time by about 30 per cent, a significant fact to the retreader who wants to increase production capacity without increasing production facilities, the company states.

Goodyear to Expand

► Goodyear Tire and Rubber Co., Akron, Ohio, has announced that it will spend $1.25 million on expansion of its Akron facilities for production of Chemigum rubber and synthetic latices. The project includes enlargement of storage and production buildings and purchase of new equipment, and is to result in a capacity increase of 15 per cent. The latex expansion includes both nitrile and butadiene-styrene types, and is due for completion in June 1961.

If compounding of rubbers and other polymers is "double, double, toil and trouble" to you, why not let our staff of witches and warlocks mix your potion in our cauldron?

We have served many users and manufacturers of polymeric materials as consultants in both compounding and evaluation. We can help you with development problems or we can take over routine testing, etc., leaving your staff free to practice the 'black arts' of new-product development to their hearts' content.

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Names in the News

Peter Macdonald, who formerly represented the Goodyear Aircraft Corp. in Washington, has been named general manager of the Goodyear Tire and Rubber Co.'s Washington office.

Lloyd H. Perry of U.B.S. Chemical Co., Cambridge, Mass., has been named chairman of the Northeastern section of the American Chemical Society for 1960-61.

Bertram L. Bernhardt has been elected a vice-president of Apex Tire and Rubber Co., Pawtucket, R. I.

William C. Foster has been appointed technical sales representative for the Southeastern states for Mobay Chemical Co., and will be assigned to the Charlotte-Richmond-High Point area.

Corliss Weltner, who joined the Sales Department in 1958, and occupied the post of senior sales correspondent, has been appointed personnel manager at the plastic products plant of the B. F. Goodrich Industrial Products Co., located at Salem, Ind.

Robert Bult, Sr., who has been managing director of Firestone's affiliate company in Pratteln, Switzerland, for the past 25 years, has been appointed president-managing director of Firestone France, with responsibility for all Firestone operations in France.

Jack E. Wright, who gained his experience in the chemical process field working for Ford, Bacon and Davis in design capacity and for other, allied firms in engineering sales, has been elected vice-president of the Kleinfeldt Co.

Bruce E. Esterly has been elected secretary of the Toledo Control of the Controllers Institute of America; **Harold W. Burkett** has been named a director of the Buffalo Control; while **C. D. Wagoner** has been named a director of Rocky Mountain Control. The three men are with Cooper Tire & Rubber Co., U. S. Rubber Reclaiming Co., Inc., and Gates Rubber Co., respectively.

William McKinnon, vice-president of B. F. Goodrich Liberia, Inc., has been made a Grand Commander of the Order of the African Star by the Liberian government.

Fred T. Kottenstette, formerly a chemical sales representative for Texas Butadiene and Chemical Corp. in the company's Houston, Texas office, has been promoted to the post of group leader, sales development, and will be located in the corporation's New York offices.

George W. Novotny, formerly with Schick Electric Shavers, Inc., has been appointed general sales manager of the Ace Bowling Co., a Division of American Hard Rubber Co., Butler, N. J.

A. J. Johnson, vice-president of the Development and Engineering Division of Shell Development Co.'s Research Center in Emeryville, Calif., will become a vice-president about the first of the year, located in the company's head office in New York, N. Y.

Richard P. Porter has joined Texas Butadiene and Chemical Corp., New York, N. Y., as manager of sales administration, and will in addition take charge of the company's advertising program.

Howard E. Padgett, formerly with the M. W. Kellogg Co. as a construction superintendent, has joined Crawford and Russell, Inc., Stamford, Conn., as construction manager of the Southern Division.

John B. Hunter, Jr., with the Procter and Gamble Co., Cincinnati, Ohio, for 20 years as an advertising executive, has joined the B. F. Goodrich Co., Akron, Ohio, as advertising manager, consumer products.

Donald I. Kyle, with the company since 1945, has been appointed manager of the Purchasing Department of Seiberling Rubber Co., Akron, Ohio.

Gene P. Robers has been appointed general sales manager of the Thermoid Division, H. K. Porter Co., Inc., Pittsburgh, Penna.

Thomas E. James, formerly manager of the company's plastic refrigerator gasket plant at New Ulm, Minn., has been named plant manager at DuBois, Penna., for B. F. Goodrich Industrial Products Co.

James B. Lovell has been appointed sales representative for the Central District of the Silicone Products Department of General Electric Co. and will be located in Milwaukee, Wisc.

Dr. Max E. Roha, formerly a senior scientist in the plastics research group, has been named manager of plastics research at the B. F. Goodrich Co. Research Center in Brecksville, Ohio.

Henry Weckbacher, formerly personnel manager at the company's plant in Salem, Ind., has been named plant manager of the New Ulm, Minn., plastic products plant of B. F. Goodrich Industrial Products Co., Akron, Ohio.

Dr. Maurice Morton, professor of Polymer Chemistry and director of the Institute of Rubber Research at the University of Akron, has been awarded the Akron Bar Association's Naturalized American Award for 1960.

Austin McLean has been appointed sales promotion manager of the Beebe Rubber Co. and will also continue to direct the sales of the Athletic Shoe Sole Division of the Nashua, N. H., firm.

William M. Gaston, formerly manager of the New York operations of the Goodrich International firm, has been named managing director of B. F. Goodrich of Brazil.

Eugene Jacobson, founder and president of Facile Corp. until it was sold to Sun Chemical Corp. last year, has been elected a vice-president of Sun Chemical.

Donald I. Kyle has been appointed manager of the Purchasing Department of Seiberling Rubber Co., Akron, Ohio, succeeding **Elmer R. Gibson** who has been with the company for 39 years and will retire.

John L. Collyer, chairman of the executive committee of the board of directors of the B. F. Goodrich Co., Akron, Ohio, has been elected a director of the Grumman Aircraft Engineering Corp.

van Arkel Addresses Ontario Rubber Group

► "Wire and Cable from the Compounders' Point of View," was the subject of the talk presented by Bernard van Arkel (R. T. Vanderbilt) before the Ontario Rubber Group at its meeting on October 11 at the Clover Leaf Hotel, Toronto, Ontario, Canada. Mr. van Arkel spoke about compounding techniques, wire and cable equipment, and properties expected of wire and cable compounds in general. His talk included both rubber and plastic constructions. He also discussed some of the new compounding techniques used by the industry at present, and he mentioned specifications which must be met by the wire and cable compounder. According to Mr. van Arkel, compared to other fields of rubber manufacture, the wire and cable industry does as much, if not more, evaluation and development with new polymers and compounding ingredients.

Golf Tournament Held

The Ontario Rubber Group held its 13th Annual Golf Tournament on September 16 at the Dundas Valley Golf & Curling Club, Dundas, Ontario, Canada. Frank Capstick (Dunlop Canada) served as chairman of the golf committee, and golf and door prizes were donated by raw material suppliers and Ontario rubber companies. The golf tournament prize winners were: *1st Low Gross, 79*, Bob Lovell (Goodrich Canada); *2nd Low Gross, 80*, Dean Bregman (Goodrich Canada); *3rd Low Gross, 81*, Charlie Pavenal (Goodrich Chemical Canada); *1st Low Net, 64*, Frank D. Evans (Naugatuck Chemical); *2nd Low Net, 67*, Tom R. Smith (Mansfield Rubber Canada). Dick Knowlton (Goodrich Canada) received a replica trophy for winning the golf tournament in 1959.

The Ontario Rubber Group, in conjunction with the Division of Rubber Chemistry of the Chemical Institute of Canada, is planning an advanced course in rubber technology. The course will begin on January 11, 1961, and be given at Ryerson Institute of Technology, Toronto. Ten lectures will constitute the course, they are: (1) Emulsion Polymerization; (2) SBR Nitrile; (3) Neoprene, Hypalon, Viton; (4) Solution Polymerization; (5) Butyl; (6) Polyisoprene; (7) Natural Rubber; (8) Chemistry of Carbon Black; (9) Physical Chemistry of Carbon Black; and (10) Non-Black Fillers.

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- **Cuts Almost all Materials** . . . The Hytronic cutting machine, capable of 30,000 lbs. hydraulic pressure, easily cuts a wide range of materials including aluminum, asbestos, copper, paper, linoleum, plastic, plywood, cloth, leather, masonite, rubber . . . cuts with exact uniformity from top to bottom.

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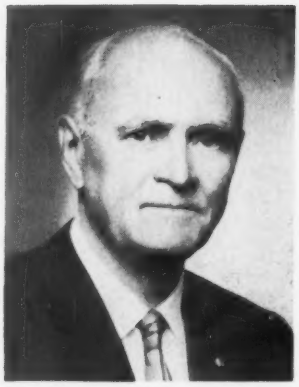
Wins 1961 Goodyear Medal

► Dr. Herbert A. Winkelmann, co-inventor of the first antioxidant for rubber to be marketed, and holder or co-holder of 48 patents in the field of rubber technology, has been named to receive the Charles Goodyear Medal by the Division of Rubber Chemistry, American Chemical Society. The gold medal, which is given annually for outstanding contributions to rubber chemistry, will be presented to Dr. Winkelmann during the Division's 79th meeting in Louisville, Ky., in April, 1961. Dr. Winkelmann is vice-president and technical director of the Dryden Rubber Division of the Sheller Manufacturing Corp., Chicago, Ill.

He received a B.A. degree at Northwestern College in 1914 and an M.S. degree in 1915. In 1919, he received his Ph.D. from the University of Illinois. Dr. Winkelmann was a captain in the Chemical Warfare Service in World War I, and afterwards joined B. F. Goodrich Co., Akron, Ohio, serving successively as research chemist, development manager, and superintendent of the Tire Division. He was chief chemist of the Philadelphia Rubber Works Co., Akron, Ohio; technical director of the Palmer Gas Products Co., Chicago, Ill.; and vice-president of the Marbon Corp., Chicago, Ill.; before joining the Sheller Corp. in 1937.

Dr. Winkelmann has served as instructor in synthetic rubber at the Illinois Institute of Technology and the University of Notre Dame. He is former chairman of the technical committee on automotive rubber of the Society of Automotive Engineers and the American Society for Testing Materials, rubber consultant to the Army Chemical Center, and vice-chairman of the technical committee of the Kentucky Copolymer Corp.



H. A. Winkelmann

He has published scientific papers describing chemical agents to accellerate the vulcanization of rubber, antioxidants to give it longer life, the development of balloon tires for buses, the uses of scrap and reclaimed rubber, the use of plastics, the testing of automotive rubber compounds for weathering and cracking resistance and the vulcanization of rubber by radiation. One of his most recent developments is a method of rubber-coating sponge products which makes fabric coverings unnecessary and eliminates flaking of weather-strips on automobiles.

Last January he was awarded the certificate of appreciation of the Society of Automotive Engineers for his contributions to rubber chemistry as related to the automotive industry.

Tax To Hit Tire Makers

► The Ways and Means Committee of the House of Representatives has approved a tax bill which, according to industry experts, would make the manufacturer liable for the tax on a tire a month after he puts it in stock. Under the present law the maker of a tire pays the tax to the Government after sale of the product to the customer at retail, but the independent tire dealer is liable a month after he receives the tire in stock. Independents have long complained that this ties up large amounts of their capital unnecessarily. The measure will now go to the floor of the House.

Firestone Adds Plant

► A new polymer plant at Orange, Texas, scheduled for completion in January, will increase Firestone Tire and Rubber Co.'s capacity for the production of synthetic rubber by nearly 12 per cent, according to the company. The plant, an addition to the Firestone Petrochemical Center, is designed to produce both Coral and Diene, and will have an annual total capacity of 30,000 tons. Production of Diene will begin soon after construction is completed. The plant is designed to permit the easy switch from production of one to the other of the new synthetics, according to demand.

Simon Collier

Awarded Edwards Medal

► Simon Collier, former director of quality control, Johns-Manville Corp., New York, N. Y., and author of two articles on rubber goods which have appeared in RUBBER AGE, has been named to receive the Edwards Medal of the American Society for Quality Control. He and George D. Edwards, after whom the award is named, were honored at the Society's 14th Convention Banquet on May 25 at the Sheraton-Palace Hotel, San Francisco, Calif. The Edwards Award is given for "Outstanding leadership in the American Society for Quality Control and in the practical use of modern methods of quality control, especially by application procedures, or by the organization and administration of quality control work."

Mr. Collier is a former chairman of the New York Rubber Group and a former member of the board of directors of the Rubber Division of the American Chemical Society.

He holds a B.S. in chemistry from the Worcester Polytechnic Institute. From 1916 to 1917 he was a rubber chemist at the Boston Belting Co., Roxbury Center, Mass.; from 1917 to 1918 he was an assistant chemist in rubber at the National Bureau of Standards, Washington, D. C.; from 1918 to 1919, a rubber chemist at Boston Belting, again; and from 1919 to 1923 he returned to the National Bureau of Standards as an associate chemist in charge of rubber work. He joined Johns-Manville in 1923, and until 1936 was manager of the Inspection and Control Department. From 1936 to 1946 he was staff manager of the Inspection and Control Department. He was appointed director of quality control in 1946.

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Financial News

Nat'l Rubber Machinery

► Six months ended June 30: Net income was $111,241, down 35 per cent from the preceding year's $170,561, with comparative earnings per share 53c for 1960 and 83c for 1959. The income slump was in spite of a 125 per cent rise in sales to $12,419,186, from $5,508,573. According to company President Paul A. Frank, the rise in sales was due to the company's new autoform tire vulcanizer, which was well received. He went on to say that "Most of the expenses which cut deeply into profits are non-recurring and our earnings for the balance of the year should show a decided improvement."

Mansfield

► Six months ended June 30: Estimated net earnings amounted to $196,043, or 14c per share, compared to $1,101,667, or 77c, a year ago. Consolidated net sales totaled $32,549,868, compared to $34,876,480 for the same period in 1959. Mansfield's equity in the undistributed net income of affiliated companies for the first half year totaled $310,444, equal to 22c per share of Mansfield common. A year ago at six months such equity amounted to $441,382, equal to 31c per share.

Columbian Carbon

► Six months ended June 30: Net income totaled $4,026,000, equal to $2.49 per share, compared to $3,485,000, or $2.16 per share in 1959, the 1959 figure excluding a special charge of $490,000, or 30 cents a share. Net sales were $41,355,000, up from $36,618,000 for the like period of 1959. For the quarter ended June 30 net income was $1,917,000, equal to $1.18 a share, with sales for the period amounting to $21,088,000.

Acme-Hamilton

► Six months ended June 30: Net income of $454,001, equal to 12c a share, included $312,671 from the sale of a capital asset. Net sales for the period amounted to $8,781,441.

U.S. Rubber Reclaiming

► Six months ended June 30: Net income climbed slightly to $298,254, or 67c a share, compared with $294,090, or 66c a share, in the first half of 1959. Net sales were $3,947,020 as against $3,721,345 last year. Second quarter net income dipped to $149,464, or 33c, compared with $167,529, or 37c, last year, and net sales were $1,843,565, compared with $1,981,286 in 1959. According to the company the decline reflected a slackening in movement of reclaimed rubber inventories during the spring buying period.

Firestone

► Nine months ended July 31: Net income increased 3.2 per cent to $46,096,273, or $1.74 a common share, from $44,675,914, or $1.69, cleared in the like period of the preceding fiscal year. Net sales rose 4.3 per cent to $883,639,399, from $847,453,946 a year ago. Raymond C. Firestone, president, foresees a period of growth and expansion in the rubber industry, and the company, at this time, is investing $120 million in a program of plant expansion and modernization.

Lee Rubber

► Nine months ended July 31: Net income was $426,847, or 50c a share, compared with $1,079,907, or $1.26 a share cleared in the period in the previous fiscal year. Net sales fell to $33,016,637 from $37,662,253.

Sheller Manufacturing

► Six months ended June 30: Net income amounted to $940,229, or 99c per share of common stock, compared to $869,431, and 91c, the like period last year. Sales were up to $26,096,081, from $22,458,196.

Sandura Co.

► Six months ended June 30: Net income dropped to $203,831, equal to 94c per share, down from $437,131, or $2.83, reported for the comparable period a year ago.

Dayco Corp.

► Nine months ended July 31: The company reported an operating loss of $2,607,830, as opposed to the earnings of $1,816,301, or $1.64 a share, reported for the same period of 1959. Sales of $73,050,089 for the period compared with sales of $71,802,930 for the nine months period last year. The company termed the poor showing a result of "unforeseen" and "extraordinary events." Special write-offs against income, totaling $3,800,000, led to the loss. They were ordered because of a decline in tire and foam rubber prices which affected the industry as a whole, rising costs of labor and materials, and the unexpectedly high start-up costs of a new plant in Springfield, Mo.

Pantasote

► Six months ended July 31: A profit of $82,229, or $74,960 after taxes, compared with a profit of $279,356 for the same period of 1959, when there were no taxes paid because of a loss carry forward. According to the company, the operation of new facilities — to be completed in September — which will more than triple the company's output of polyvinyl chloride resin, should result in increased earnings during the last four months of the current year.

Standard Products

► Year ended June 30: Net profit was $464,233, or 61c a share, compared to $708,553, or 94c, for the preceding year. Sales of $39,419,170 showed a gain of 15 per cent over the $34,413,915 sales of the year before.

Triangle Conduit

► Six months ended June 30: The company reported a net income after taxes of $624,542, equal to 46c per share, compared to $1,338,071, or 98c for the like period of 1959. Sales were down to $25,908,350, from $31,231,912 a year ago.

Kleinert Rubber

► Six months ended June 30: Net income totaled $378,000, or $1.28 per share, compared to $355,555, or $1.19, for the like period a year ago. Net sales amounted to $8,985,000, compared to $8,248,991.

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...THROUGHOUT THE WORLD

Since 1940, a total of 74 predip and calendar lines for rayon and nylon tire cord fabric production have been designed and built by C. A. Litzler engineers for leading tire manufacturers throughout the world. In addition to these prime production installations located in 32 countries around the globe, 22 Compu-treaters — precision laboratory impregnation lines introduced in 1957 — have been built for worldwide customers.

All of these production units are in profitable operation today, and a substantial number of them represent repeat orders based on outstanding performance of an initial unit or line.

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New York Hears About Specialty Rubbers

► A symposium on specialty rubbers was presented at the technical meeting of the New York Rubber Group on October 21 at the Henry Hudson Hotel in New York City. The meeting was attended by over 200 members and guests. The papers presented at the symposium were: "Applications of a Nitrile-Vinyl Polymer Blend," by A. S. Krivitsky (Naugatuck Chemical); "The Effect of New Vinyl-Containing Polysiloxane Polymers on the Inherent Characteristics of Silicone Rubber," by C. W. Roush (Dow Corning); and "Fluid Viton—A New Development in Fluoroelastomers," by R. C. Deskin (DuPont).

The results of the election of officers and directors for 1961 were announced at the meeting. The new officers are: *Chairman,* Henry J. Peters (Bell Laboratories); *Vice-Chairman,* Ralph DeTurk (Cooke Color & Chemical); *Secretary-Treasurer,* Robert G. Seaman (*Rubber World*); *Sergeant-at-Arms,* Wilbur Birkitt (Passaic Rubber); *Directors,* Ralph T. Ambrose (Rodic Chemical); Kenneth B. Cary (Woodbridge Plastics); Warren C. Carter (American Hard Rubber); and A. M. Gessler (Esso Research).

After-Dinner Program

After-dinner entertainment included the showing of a color film of the events and persons participating in the 1960 Summer Outing of the New York Rubber Group, and a talk on "Instrumentation in Crime Detection," by Detective Kevin P. O'Brien of the New York City Police Laboratory.

At the symposium on specialty rubbers, the first speaker, Mr. Krivitsky, stated that since nitrile rubbers such as Paracril and polyvinyl resins are compatible polymer blends, Paracril Ozo possess some very desirable properties obtained by combining these materials in a unique manner. According to the speaker, the excellent ozone and abrasion resistance, color retention and fuel-oil resistance of Paracril Ozo vulcanizates simplifies the compounder's job in many applications, particularly in those areas where color and ozone resistance are of prime importance.

Mr. Krivitsky presented data and slides illustrating the advantages of Paracril Ozo, and suggested the use of Paracril Ozo for shoe soles, wire and cable jackets, hose covers, belt covers, white sidewalls, and all types of extruded and molded goods.

The speakers at the technical meeting of the New York Rubber Group, seated, left to right, R. C. Deskin (DuPont), A. S. Krivitsky (Naugatuck Chemical), and C. W. Roush (Dow Corning), discuss the symposium program with, standing, left to right, Henry J. Peters (Bell Laboratories), vice-chairman of the New York Rubber Group and chairman-elect for 1961, and Ervin S. Kern (R. T. Vanderbilt), group chairman for 1960.

The second speaker, Mr. Roush stated that vinyl modification of polydimethylsiloxane affects the vulcanization characteristics and the vulcanized properties of silicone rubber. He pointed out that vulcanization is more efficient and less vulcanizing agent is required for optimum properties.

According to Mr. Roush, the properties of the vulcanized rubber include improved compression set, confined heat and steam resistance, and at low concentrations of vinyl groups, optimum physical properties and heat resistance are obtained. He added that at high concentrations of vinyl groups, optimum resistance to decomposition in confined environments is obtained.

Mr. Deskin, the final speaker, discussed LD-227, a new product which is a low molecular weight Viton said to be of great help in processing Viton where the maximum in heat and fluid resistance is required. He pointed out that incorporation of LD-227 in typical Viton stocks reduces the viscosity of Viton A, A-HV, and B and improves their processing for uses such as molding, extruding, calendering, and others.

He explained that the accelerator level in the Viton compound is reduced in proportion to the LD-227 concentration because it will not cure in competition with Viton. According to Mr. Deskin, it has been vulcanized by itself, but a large excess of accelerator is required and the vulcanizate is hard with no elastomeric properties. The speaker remarked that some other uses being investigated are as a plasticizer for silicone rubber to improve fluid resistance of silicone; as a caulk; and as an aid in making higher solids Viton solutions.

Retires from Davol

► Ezra L. Hanna, chief chemist and technical director of Davol Rubber Co., Providence, R. I., retired recently. He had been with the company 43 years. He graduated from Buchtel College, which became the municipal University of Akron, in 1915 with a B.S. degree in chemistry, and became associated with the Star Rubber Co., Akron, as a chemist. In 1917 he joined Davol as chief chemist. He served in the U. S. Army and Chemical Warfare Service during 1918 and 1919, afterwards returning to Davol. In 1952 he was named technical manager. He was the third president and a director of the Rhode Island Rubber Club, and a director of the Rubber Division of the American Chemical Society.

► "Sheet Made from Leather Scrap with Hycar Latex," is the subject of Hycar Latex Newsletter Issue No. 20, May, 1960. The data, based on tests and including graphs, is available from B. F. Goodrich Chemical Co., Cleveland, Ohio.

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to separate sheet or slab stock and lubricate with perfect tack control

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5. Leaves a glossy, non-greasy finish that adds appearance appeal.

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West Coast News

► The name of the Oronite Chemical Co. of San Francisco, Calif., has been changed to the Oronite Division of the California Chemical Co. The change results from a decision of the Standard Oil Co. of California, the parent company, to further expand into chemicals. To facilitate this move, Standard Oil is consolidating all of its chemical interests under California Chemical. T. G. Hughes, formerly president of the Oronite Chemical Co., will continue to head the Oronite Division. It is stressed that the new reorganization will not affect product lines or personnel.

► Dick Roosevelt has been appointed West Coast sales representative for G. F. Goodman & Sons, manufacturers of machinery for the rubber industry. He received a B.S. degree in marketing and industrial management from Ohio University in 1941. Currently he heads his own company, R. A. Roosevelt Co., Bell, California.

► The man who holds what is believed to be the longest record of continuous service of any Southern Californian in the rubber industry, H. R. "Hallie" Braley, retired recently. Mr. Braley, a division superintendent at the Los Angeles plant of the Goodyear Tire & Rubber Co., completed 49 years with the company on July 23. He began his employment with Goodyear at Akron, Ohio, in 1911 and transferred to the Los Angeles plant on April 15, 1920, two months before the local factory began production.

He started his career in the rubber industry as a tire builder and had worked his way up to night foreman at Akron before the Los Angeles plant had been built. He came to Los Angeles as a department foreman, later was promoted to general foreman and since 1943 has been a division superintendent.

► Ray Tate and R. L. "Dick" Wells are now associated with H. M. Royal, Inc., Downey, Calif., in sales. Mr. Tate was formerly associated with California Hardware Co. in sales. Mr. Wells was formerly associated with Firestone Tire and Rubber Co., Los Angeles in purchasing.

► The Synthetic Rubber Division of Shell Chemical Co. has opened two new regional sales offices as part of its expansion program. The western district sales office is now located at 5230 Clark, Lakewood, Calif., and the central district office in the Union Commerce Building, Cleveland, Ohio.

► Al Federico has been named president of C. P. Hall Co. of California. Jim Modawell is now vice-president in charge of sales.

► Howard E. Hughes has been named manager of Shell Chemical Company's new synthetic rubber plant to be built near Marietta, Ohio, according to J. P. Cunningham, general manager of the company's Synthetic Rubber Division. The new plant to be managed by Mr. Hughes will be a multimillion dollar complex designed to produce 80,000,000 pounds of polyisoprene a year. It will be located on a 300-acre site on the Ohio River 15 miles west of Marietta.

► Walter J. Baird has been named Los Angeles sales representative for the Sundries Division of B. F. Goodrich Industrial Products Co.

U. S. Rubber Nylon Tire

► A low-priced nylon passenger tire with extra body strength and improved skid and traction performance has been introduced by the U. S. Rubber Co., New York, N. Y. The tire, called U. S. Royal Air Ride, is pressure tempered after vulcanization, to give it greater dimensional stability, more mileage and more dependable performance. It is available, with or without a two-inch wide sidewall, in sizes 6.00-16, 6.70-15, 7.10-15 and 7.60-15, all tubed type, and 7.50-14 tubeless. The 7.50-14 tire has a heavily inserted, seven-row tread design.

Colonial Addition Slated

► Colonial Rubber Works, Inc., will expand its plant at Dyersburg, Tenn., by 20,000 square feet pending a $325,000 bond referendum to be held soon. About 100 additional employees will be hired.

Cabot Organization Adopts New Name

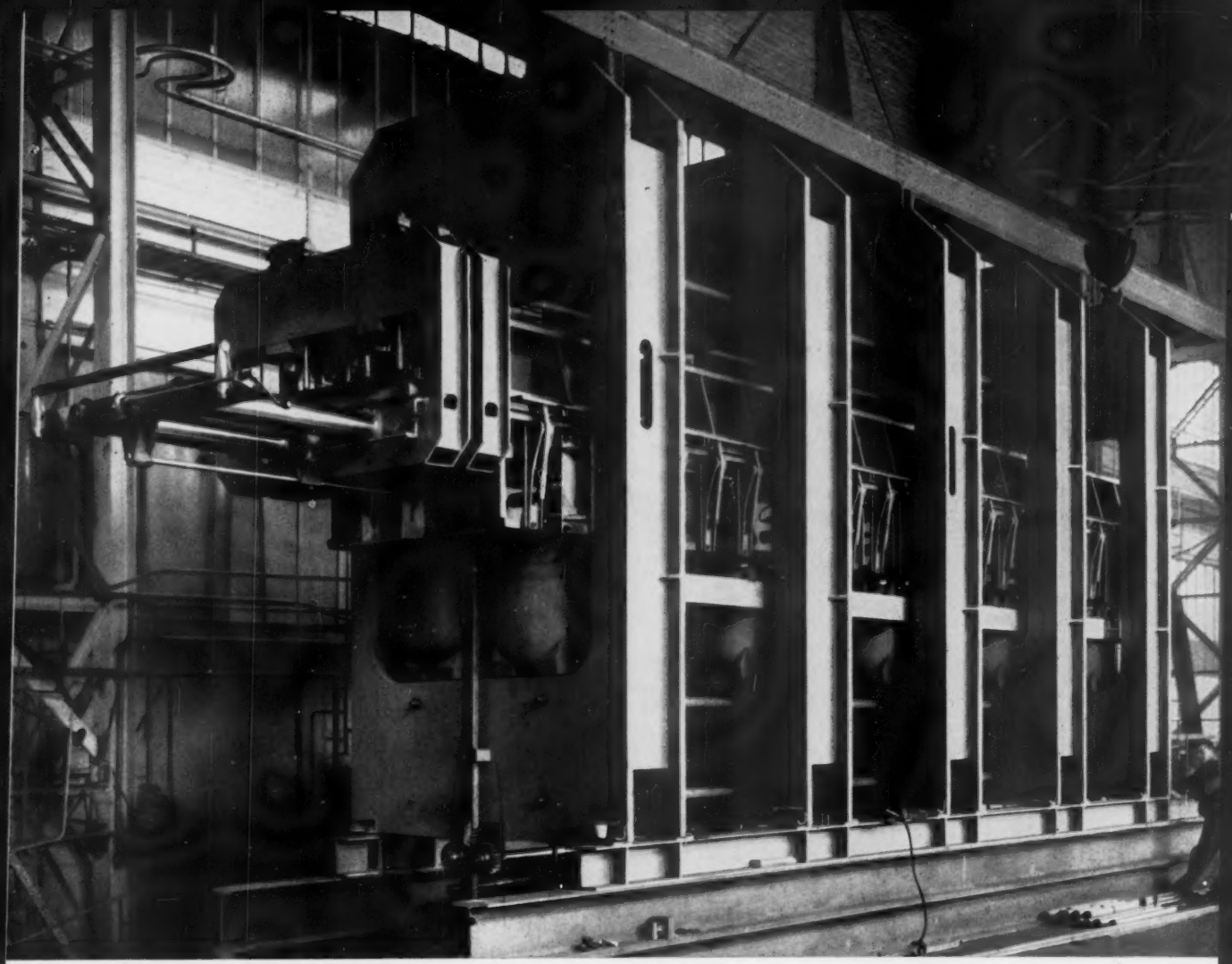
► Godfrey L. Cabot, Inc., Boston, Mass., has announced the consolidation of three newly acquired subsidiaries and the parent company under a new corporate name, Cabot Corporation. The three subsidiaries concerned are Cabot Carbon Co., Cabot Shops, Inc., and Cabot Gasoline Corp. The organization was originally incorporated under the name of Godfrey L. Cabot, Inc., in 1922.

The company began operating in 1882 under its present chairman of the Board, Dr. Godfrey L. Cabot, as a small plant at Buffalo Mills, Penna. Since its inception, the organization's policy has been diversification into fields where its particular knowledge and skills give greater ability to compete, while furthering the development of its own major current products. Today, within the United States, Cabot Corporation produces carbon black, natural gas, liquefied petroleum gases and natural gasolines, crude oil, pine tars, charcoal and charcoal briquets, Cab-O-Sil silicon dioxide, a non-metallic mineral called Cab-O-Lite, portable well-drilling and servicing equipment, oil field pumping equipment and steel fabrication.

Petrocarb, Inc., a subsidiary engineering firm, specializes in a high temperature, refractory equipment and materials; Cabot Engineering Co., another subsidiary, is engaged in plant design, engineering, construction and maintenance. The corporation is also a major stockholder in two petro-chemical concerns in the Southwest. Subsidiary companies produce carbon black in Canada, England, France and Italy; and Cabot operates a plant in Australia jointly with another major U.S. carbon black producer.

R & H Revamps Plant

► Rohm & Haas Co., Philadelphia, Penna., has announced plans to convert a surplus butadiene plant at Louisville, Ky., recently acquired from the Government, to production of monomers and polymers. The chemical company said a construction contract has not yet been let and production operations will not begin before mid-summer of 1961. Construction is expected to go on for more than a year. The Louisville location gives the company a plant closer to Midwest markets.



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Canadian News

► Thomas D. Cabot, Jr., has been elected president of Texas Butadiene & Chemical International, Ltd., a wholly-owned subsidiary of the Texas Butadiene & Chemical Corp. The Canadian company is presently engaged in overseas sale of butadiene and synthetic rubber. To strengthen its overseas marketing organization, the Canadian company will open a branch office in Lausanne, Switzerland. James F. O'Haren will serve as European Commercial Manager and will supervise the Swiss office. Dr. C. Wheaton Vaughan, recently appointed assistant director, Development Department, will assume responsibility for the company's technical and development activities in the European area. His headquarters will be at Lausanne.

► M. E. Pickett, Jr., has been made a vice-president of Columbian Carbon (Canada), Ltd. and general manager of the Carbon Black and Pigment Division. President A. W. Guthrie announced that C. M. Croakman will continue as vice-president in charge of sales of the division. The Canadian company is a wholly-owned subsidiary of Columbian Carbon Co. of New York, N. Y. The company is currently building a carbon black plant in Hamilton, Province of Ontario, Canada.

Mr. Pickett graduated from Mississippi State University in 1942 with a B.S. degree in chemical engineering. He joined the Columbian Carbon Company in 1945. Since 1957 he has been supervisor of furnace and channel black quality control at production headquarters in Monroe, Louisiana. Mr. Pickett is a member of the American Institute of Chemical Engineers, American Chemical Society and American Society for Quality Control.

► Appointment of Neil B. Roberts as area sales manager for Europe has been announced by J. T. Black, general sales manager for Polymer Corporation, Ltd., Sarnia. Mr. Roberts came to Polymer in 1952 as technical sales representative and was assigned to London in 1956. He succeeds S. C. Kilbank who has been assigned to a special project. Mr. Roberts graduated from Sydney University, Australia.

Elected President of U.S. Rubber

► George R. Vila has been elected president and chief operating officer of U. S. Rubber Co., New York, N. Y., succeeding John W. McGovern, who has retired after 40 years with the company. Mr. McGovern will continue as a member of the board of directors and executive committee. Mr. Vila was formerly executive vice-president responsible for the operations of the company's Naugatuck Chemical, Textile, International and Plantation Divisions as well as the subsidiaries, Dominion Rubber Co., Ltd. (Canada) and Latex Fiber Industries, Inc., Beaver Falls, N. Y.

Mr. Vila received a B.A. degree at Wesleyan University in 1932, and an M.S. degree in chemical engineering at Massachusetts Institute of Technology the following year. He was first associated with the Boston Woven Hose and Rubber Co., as production and development engineer. He joined U. S. Rubber in 1936 as a sales representative for rubber chemicals in the Naugatuck Chemical Division. In 1942 he was transferred to the division's Research and Development Department, and the following year he was named research and development manager for synthetic rubber. He pioneered in the development of experimental GR-S rubber, and in the adaptation of statistical control methods to the manufacture of synthetic rubber.

In 1945, he went to Germany under the auspices of the Technical Industrial Intelligence Committee to study the German synthetic rubber industry, and, upon his return to Naugatuck, Mr. Vila initiated research work which led to the development of cold GR-S. He was awarded a Certificate of Appreciation by the government for his work in this area. Later the same year he was appointed assistant general development manager for the Naugatuck Chemical and synthetic rubber divisions of the company.

In 1946, he became sales manager for Naugatuck Chemical's latex and plastic products, organizing the present Plastics and Sales Department. In 1949, he was promoted to the post of general sales manager for Naugatuck Chemical, and in 1953 he became assistant general manager of the division. He was elected a vice-president of U. S. Rubber and appointed general manager of Naugatuck Chemical in 1957, and later the same year he was appointed group executive vice-president of the company.

George R. Vila

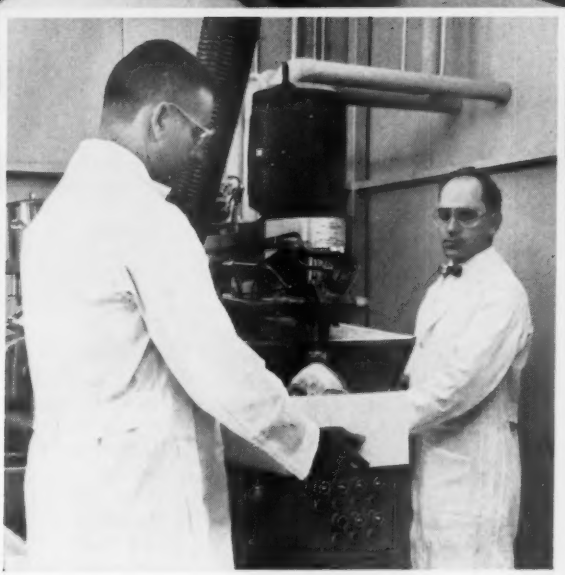
Mr. Vila is the author of many technical articles on the compounding, manufacture and use of synthetic rubber. He is a member of the American Chemical Society, Chemists' Club, Lotos Club and the Society of the Plastics Industry.

'Tyre Wear' Article

► "Tyre Wear," an article slated to appear in a forthcoming issue of *Rubber Developments*, by A. Schallamach of the British Rubber Producers' Research Association, deals with conclusions drawn from wear tests conducted on abrasion machines. The article raises the problem that abrasion resistance is not by itself the sole cause of the wear characteristics of tires. Also discussed is the unexpected influence of the resilience on wear.

British Group Officers

► H. G. W. Chichester-Miles, Empire Rubber Co., and Rubber Bonders Ltd., was elected president of the Federation of British Rubber and Allied Manufacturers' at the group's annual meeting, held on July 21 in London, England. Elected vice-presidents for the year 1960-61 were, S. D. Sutton (Veedip Ltd.) and C. H. M. Baker (Firestone Tyre & Rubber Co., Ltd.)



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With the aid of the exceptionally versatile Mobay M-13 Foam Machine (inset), we are able to evaluate new polyether and catalyst systems and develop new urethane foams having specialized or superior properties. Jefferson offers polyethers for high quality flexible, semi-rigid and rigid urethane foams . . . polyethers built with specifications to meet the industry's exacting standards. Excellent catalysts, N-methylmorpholine, N-ethylmorpholine, and the interesting amine, N,N'-dimethylpiperazine are also available in commercial quantities.

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070

Obituaries

A. G. Cameron

► A. G. Cameron, retired head of Goodyear International Corp., with Goodyear 44 years, died September 7 in City Hospital, Akron, Ohio. He was 80 years old. Mr. Cameron began his business career with a wholesale grocery firm and eventually became vice-president of the company. He joined Goodyear in 1913, as a truck tire salesman in St. Louis, Mo. Subsequently he became manager of the Dallas, Tex., and St. Louis districts. In 1919 he was called to Akron as manager of the export company's Australian Sales Division. He spent nearly a year in Australia and New Zealand organizing sales and surveying the potential markets in these countries.

In 1921 Mr. Cameron was appointed export sales manager and the following year he became vice-president and general manager of the newly incorporated Goodyear Tire and Rubber Export Co. He also became vice-president and general manager of Goodyear Foreign Operations Inc. which was established in 1939, and he was named a director of the parent company in 1940.

In 1954 he passed on his duties as head of overseas operations, continuing as a director of the company. He also served on the staff of Board Chairman E. J. Thomas until his retirement. After retiring from Goodyear, Mr. Cameron established offices in Akron and continued as a consultant on international trade. He is survived by his wife, and two daughters.

M. R. Sheild

► M. R. Sheild, office manager for Goodyear-Argentina, branch of Goodyear Tire & Rubber Co., Akron, Ohio, died June 1 in Argentina where he had held his present post since 1947. He was 51 years old. Mr. Sheild attended North Carolina State College, becoming associated with Goodyear in 1934 as a bookkeeper. Five years later he was assigned to Goodyear operations in India as credit manager, and he later became an auditor in the international field. He is survived by his wife, a son, and a daughter.

Carl A. Bartle

► Carl A. "Cabby" Bartle, a retired official of the Elastomer Chemicals Department of E. I. du Pont de Nemours & Co., Wilmington, Del., died September 29 at his home in Sarasota, Fla., following a heart attack. Mr. Bartle received his bachelor of science degree in electrochemical engineering from Pennsylvania State College in 1916, then joining the Aluminum Company of America as a research engineer at the Niagara Falls, N. Y., plant.

In 1918 he became associated with Du Pont as a chemist and later that year became a production supervisor at the company's Repauno Plant at Gibbstown, N. J. He left the following year to become chemical supervisor of production for the National Aniline and Chemical Corp. at Marcus Hook, Penna. He returned to Du Pont in 1923 and was assigned to sales in the New York office of the Dyestuffs Department. In 1925 he was transferred to the Chicago district sales office. He was appointed assistant sales manager for rubber chemicals at Wilmington, Del., in 1929, became sales manager of the Rubber Chemicals Division in 1932, and sales director in 1943. He continued to head the sale of rubber chemicals until 1958 when he was named a special assistant. He retired in November of last year.

Mr. Bartle was a past chairman of the New York Rubber Group; he was also a member of several other industry groups.

Walter A. Hazlett

► Walter A. Hazlett, retired vice-president of Goodyear Tire and Rubber Co., died at his home August 29 after a long illness. He was 73 years old. A graduate of Mt. Union College, Mr. Hazlett began his career with Goodyear in 1906 when he joined the firm as a stenographer. He became an audit clerk and in 1908 was assigned to the Cincinnati district, later becoming sales representative for Eastern Ohio, Western Pensylvania and West Virginia.

He was next named district manager of Goodyear in Pittsburgh, and then, district manager in Detroit and Cleveland. In 1923 he was appointed central division manager and he became Eastern division manager in 1926. In 1934 he went to Los Angeles as vice-president of Goodyear-California. He has also served as managing director of Goodyear Great Britain. In his last post at Goodyear he was a vice-president handling special assignments. Mr. Hazlett is survived by his wife, a daughter and a son.

John Collins

► John Collins, retired president of three valve companies, died August 8 in Akron General Hospital, Akron, Ohio, after a four-week illness. He was 65 years old. He attended Carnegie Institute of Technology in Pittsburgh. He and his partner, Fred Sinclair, founded the Sinclair-Collins Valve Co., Akron, Ohio, in 1932, and Mr. Collins designed most of the industrial control valves the company produced for the rubber, plastics and metals industries. He later founded Valvair Inc. in Akron, and Collins Valve Co. in his home town of Canton, Penna. Mr. Collins retired as president and chief officer of the three firms in 1957 and became chairman of the board of each, remaining active in management until last Fall. He is survived by his wife and two daughters.

Joseph V. Borland

► Joseph V. Borland, vice-president of Watson Standard Co., Pittsburgh, Penna., died at his home in Mt. Lebanon, Pittsburgh, Penna., on September 14. Mr. Borland was widely known in the Technical Coatings Industry. He is survived by his wife, two sons, and a sister.

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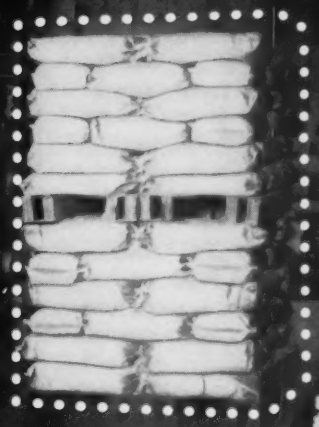
Two units on left contain 84 bags—
2.1 tons conventional zinc oxide.
(Each unit 6 bags per layer, 7 layers high.)

Two units on right contain 96 bags—
2.4 tons Protox-267 zinc oxide.
(Each unit 8 bags per layer, 6 layers high.)



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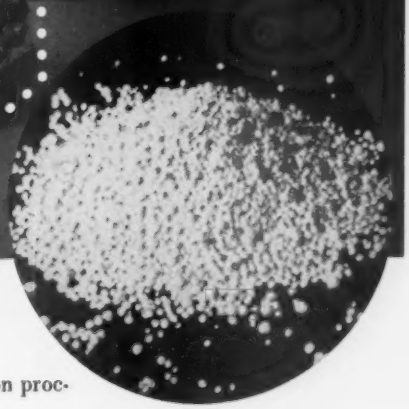

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PROTOX-267 bulks about half that of conventional zinc oxides. A 50-pound bag occupies less than 1 cubic foot of space. It flows freely . . . can be weighed out faster. Long before the pigment enters your processing operation you can start counting your savings.

But the most important savings come from PROTOX-267's faster incorporation and dispersion in rubber. The unique coating* of zinc propionate on the pigment particles makes for rapid and thorough dispersion. There are no aggregates . . . no undispersed pigment . . . no spotty cures.

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Chicago Hears Wilcox On Ozone Testing

► "The Value of the Ozone Test for Estimating the Durability of Rubber Products," was the title of a talk presented by Frank W. Wilcox (Witco) to the Chicago Rubber Group at its meeting on October 7 at the Furniture Club in Chicago, Ill. In his presentation before 185 group members and guests, Mr. Wilcox described recent advances in ozone testing and correlation between outdoor exposure and ozone cabinet tests. He remarked that the cracking of rubber products when exposed to weather or ozone presents a major problem. He explained that when rubber under stress is exposed outdoors, it often does not follow a normal expected aging cycle, thus its weathering characteristics are highly unpredictable.

The speaker pointed out that factors such as ultra violet light, extremes in temperature and atmospheric gases, particularly ozone, are directly or indirectly responsible for its erratic behavior. Mr. Wilcox stressed that since these factors vary with location and season, the true weather aging properties of a rubber compound are necessarily determined by long term exposure, preferably under actual service conditions.

1960-1961 Group Officers

The new officers and directors of the Chicago Rubber Group for 1960-1961 are: *President*, Stanley Choate (Tumpeer Chemical); *Vice-President*, Ted Argue (Roth Rubber); *Secretary*, Robert Kann (Goodyear); *Treasurer*, Harold Stark (Dryden Rubber); *Directors*, James Dunne (United Carbon); Dick Huhn (Harwick Standard); Al Mann (Judsen Rubber); Irwin Nejdl (Ideal Roller); Stanley Shaw (Witco); Harold Shetler (Chicago Rawhide); Frank Smith (Williams Bowman Rubber); and Melvin Whitefield (Naugatuck Chemical).

John Groot (Dryden Rubber), past-chairman of the Chicago Rubber Group, awarded a Life Membership in the group to Paul Niessen (Victor Mfg. & Gasket), who had served as group chairman during 1949-1950.

Soviet Output Rises

► The Soviet Union's output of rubber and chemicals was up 11 per cent in the first half of 1960 over the same period of 1959. Soviet production of synthetic resins and plastics rose 7 per cent in the first half, with polyethylene up 66 per cent, carbamide resins 56 per cent higher, and polystyrene and styrene copolymers up 23 per cent, according to the Central Statistical Board of the USSR Council of Ministers. Total industrial output rose more than 10 per cent in the first half and topped the goal of the current Seven Year Plan by 4 per cent.

► Rubber Chemicals Bulletin No. 33, "A Study of ISAF Carbon Black and Oil Levels in Oil-Extended Rubber," has been made available, in loose-leaf form, by Phillips Chemical Co., Akron, Ohio. The bulletin presents a systematic evaluation of various levels of Philblack I and a highly aromatic oil in a typical tread compound.

The 1960-1961 officers of the Chicago Rubber Group. They are, seated, *President*, Stanley Choate (Tumpeer Chemical); standing, left to right, *Secretary*, Robert Kann (Goodyear); *Vice-President*, Harold Stark (Dryden Rubber); *Treasurer*, Ted Argue (Roth Rubber).

In Vinyl Foam Coated Fabrics It's

CELOGEN®-AZ

For... Uniform Blow
...Uniform Quality
...Dependable Supply

Here is a typical starting-point formulation for calendering:

MARVINOL VR-31	100 parts
Dioctyl phthalate	70
Butyl benzyl phthalate	30
Stabilizer	3
CELOGEN-AZ	5
Stearic acid	0.5

Ingredients are preblended, Banbury-mixed and calendered using conventional equipment and techniques, excepting that stock temperatures are kept below 300° F. Expansion is accomplished by passing the sheet or laminate through an oven set at or above the blowing temperature of the compound, about 380° F.

For spread coating the following starting-point recipe is suggested:

MARVINOL VR-50 or VR-53	100 parts
Dioctyl phthalate	70
Butyl benzyl phthalate	30
Stabilizer	3
CELOGEN-AZ	4

Ingredients may be paint-milled or simply stirred in. Casting and lamination or direct coating can be done with conventional equipment. Fusion, lamination and expansion are accomplished simultaneously at 380-400° F.

The foregoing recipes and conditions are shown merely to illustrate the relative ease with which CELOGEN-AZ can be used to impart the advantages of cellular structure to coated fabrics and other vinyl laminates. Many variations and adaptations are possible.

For more detailed information or discussion of a particular problem, call upon your Naugatuck Technical Representative.

Naugatuck Chemical

Division of United States Rubber Company

Naugatuck CELOGEN-AZ

By the World's Leader in Blowing Agents

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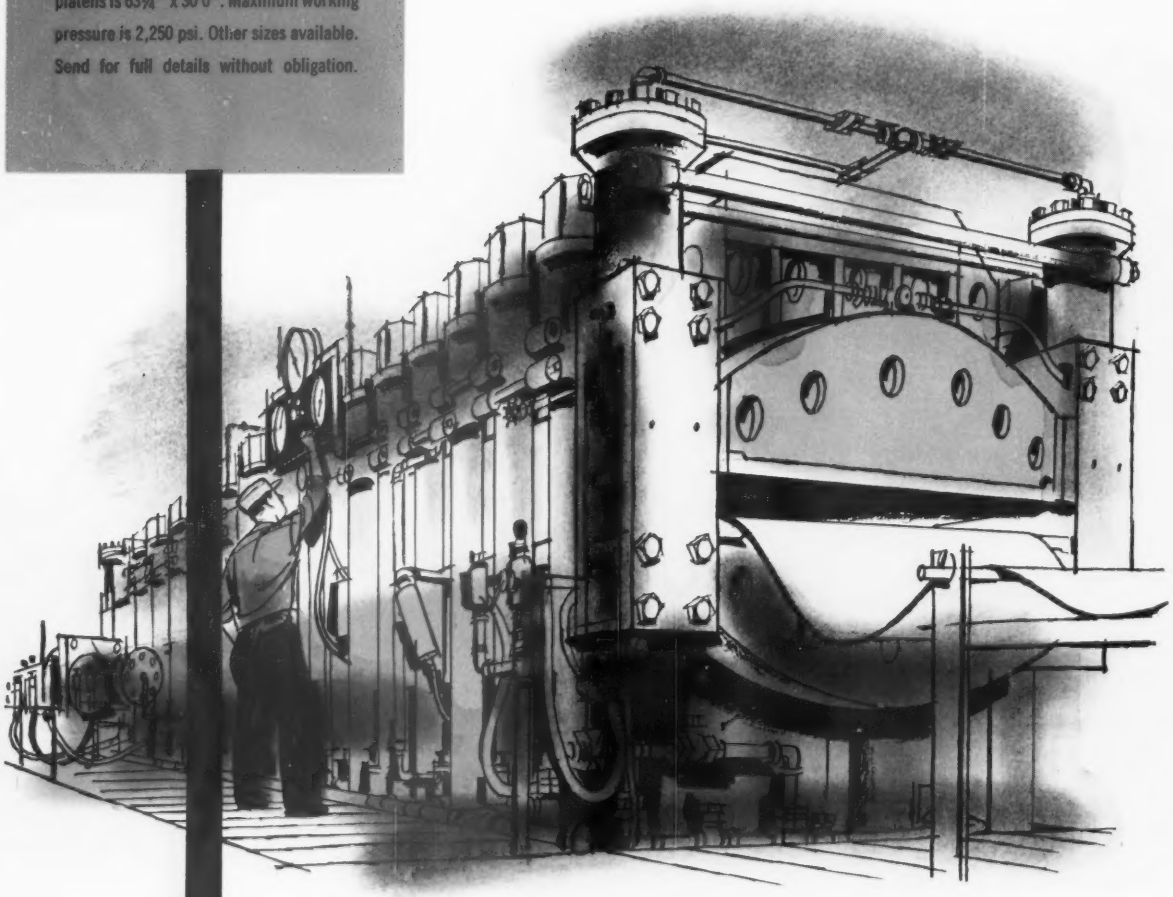

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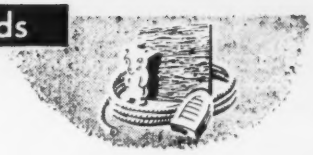


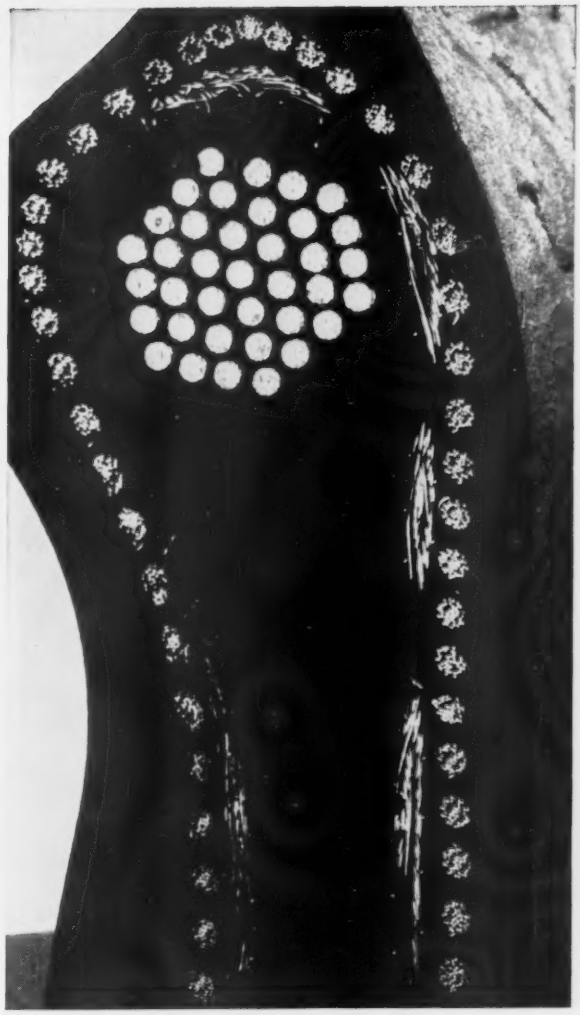
Industrial Access Doors

► Rubber-armored access doors for industrial plants, intended to withstand the shock impact of fork-lift trucks as they pass through, are being produced by American Hard Rubber Co., at its Butler, N. J., plant. Durador, the product, has a core of fiberglass, and is said to be tough, light and non-warping. The door edge is protected by soft rubber, ¾-inch thick, making the closure draft-tight and split-proof, and the doors are fit-

ted with shatter-proof windows of clear Lucite. A specially-designed all-rubber hinge extends the full length of the door, and is said to absorb shock without damage and to provide silent, positive action. It has no moving parts to wear or become jammed, needs no lubrication, is unaffected by corrosive atmosphere, encases and protects the back edge of the door, sealing against drafts, according to the manufacturer. Because the entire door is sheathed in rubber, it is resistant to corrosion, and specially recommended by the company for use in places where corrosive fumes may present a problem.

Goodyear Plastic Coating

► A vinyl plastic coating, developed by the Chemical Division of Goodyear Tire & Rubber Co., Akron, Ohio, is said to be helping farmers solve grain and hay drying problems outdoors—even in the rain. In this application, grain and hay can be dried by the wagon load under nylon hoods with a vinyl resin coating made from Pliovic WO. The company reports that the vinyl plastic can be fused to the nylon at low temperature without weakening the basic fabric, and provides a finished fabric which stands up well to weathering, acid, and alkali conditions.



WIRE-IN-RUBBER

. . . problem solved

The hexagonal bead in the photo above is a new type of tire bead developed for use in single wire-ply tires where conventional square beads are not practical. Hexagonal bead grommets are already in metal-ply bus and truck tires now on road tests and under development.

The design and manufacture of a special bead-winding machine for producing a variety of bead-grommet cross sections is another National-Standard contribution to the rubber industry. It is typical of the many solutions to wire-in-rubber problems that have come from National-Standard engineers for over 50 years. Call National-Standard for help in solving your wire-in-rubber problems.

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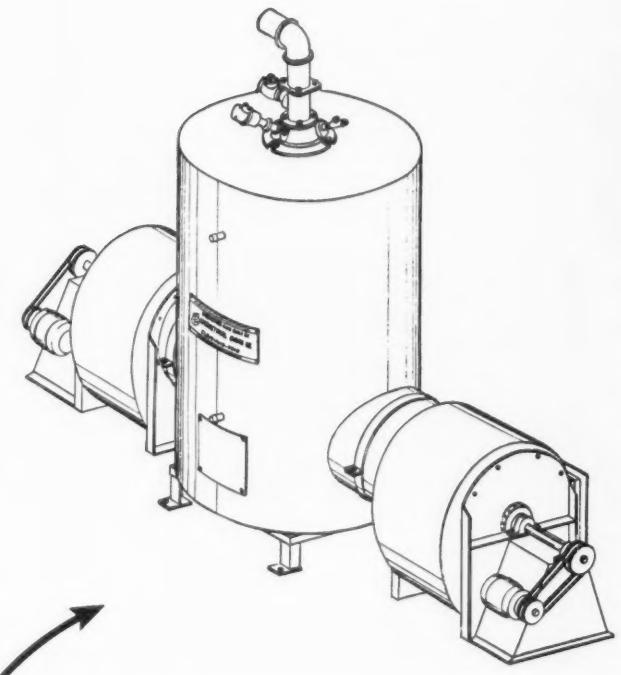

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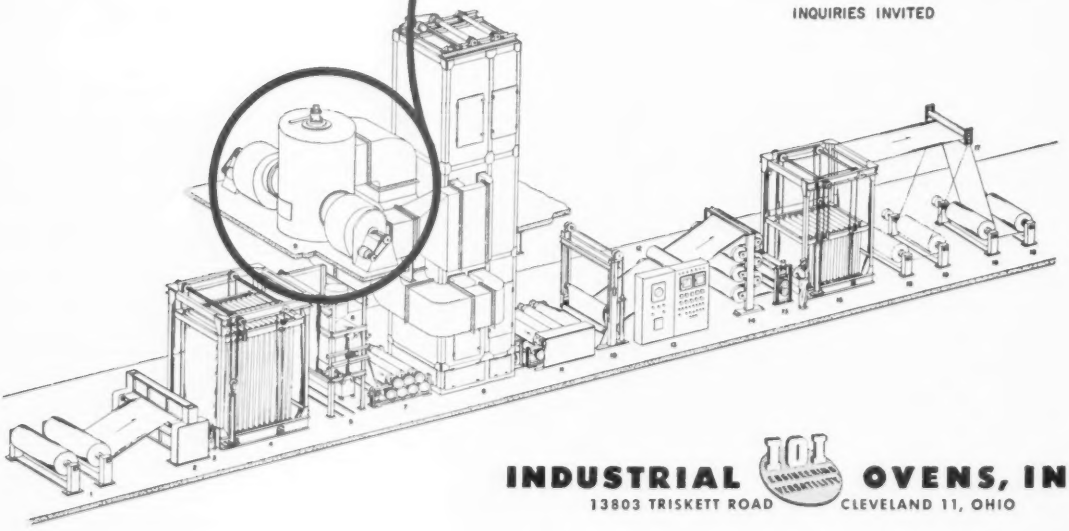

INDUSTRIAL OVENS, INC.
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All-Weather Entrance Mat

► A group of all-weather entrance foot mats featuring the word "welcome" is being marketed by Ace Rubber Products, Inc., Akron, Ohio. The Ace Gold Band Glam-R-Mat incorporates a wide center section of perforated rectangles on a bias, to give a two-way scraping action, and the "welcome" is set off in brilliant gold mylar back-

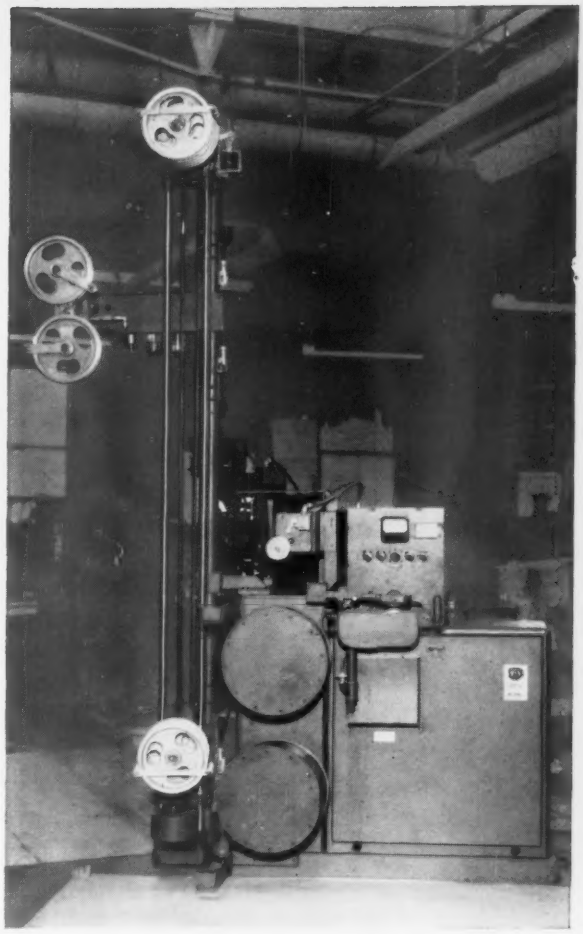
ground. According to the company, the mat is safe for spike heels, and dirt and water drop through. Corrugated panels, for final wiping, surround the center scraping section. The Gold Band mat is 36 by 19 inches. Ace Gold Shield Glam-R-Mats come in 36 by 19 inch and 30 by 16½ inch sizes, and are decorated with a gold mylar shield with a coat-of-arms. The mats come in black or brown.

Goodrich Fuel Cells

► A rubber and fabric fuel cell that is said to stand repeated shock loads at ten times the pull of gravity and temperatures down to —65°F. is being produced by B. F. Goodrich Aviation Products Division, 500 S. Main St., Akron, Ohio. The cell is being supplied to U. S. Army Ordnance for its new M-113 amphibious personnel carrier. The fuel cell has a 90-gallon capacity and measures about 47 inches long, 14 inches wide, and 32 inches high to fit the exact contour of the M-113 fuel compartment. The flexible cell is 2-ply construction using a nylon fabric barrier coated on the outside with Hycar rubber using a Hycar inner liner. It is built to stand AV gas used by the M-113.

Rubbermaid Butter Dish

► A butter dish, being introduced by Rubbermaid Inc., Wooster, Ohio, is made of a plastic which is said to be durable, odorless, and unaffected by refrigerator or automatic dishwasher temperatures. The unit consists of a slip-proof cover and a tray with the edges raised to permit easy handling. The dish holds a ¼ pound stick of butter and is available in yellow with white, turquoise with white; or yellow, turquoise and white solid colors.



WIRE-IN-RUBBER

. . . problem solved

Since early 1930's, National-Standard has been the leader in the design and manufacture of tire bead equipment. Shown above is the latest in the continuing National-Standard product redesign and improvement program—the new Model PFB Pull-off and Festooner. This unit pulls wire from the let-off reels at a rate up to 1000 feet per minute through bead insulating heads, stores and continuously feeds the insulated wire to NS-designed bead machines. The new model features dual-speed control, new safety devices and a direct drive gear reducer, to improve efficiency and output for tire manufacturers.

This is another National-Standard contribution to the improvement of wire-in-rubber processing. Call National-Standard for help in solving your wire-in-rubber problems.

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NATIONAL-STANDARD COMPANY

Niles, Michigan

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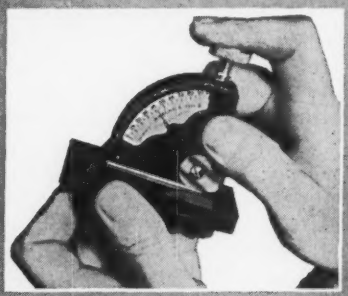

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Neoprene Glove Firmhold Finish

► Wil-Grip Firmhold Finish has been added to the neoprene glove produced by the Wilson Rubber Co., Canton, Ohio. In addition, the company is making available a new line of white neoprene gloves. The Firmhold Finish glove comes in three weights of black neoprene and in two weights of

white neoprene. The special finish, composed of minute cross-hatches of material to provide a rough, gripping surface, is molded directly into the fingers and palms of the gloves. It is said to give added gripping and holding friction on wet or slippery surfaces. The glove will not deteriorate from age or exposure to sunlight and is allergen-free.

Goodyear Specialty Hose

► A rugged new hose said to withstand the high pressures and temperatures encountered in creameries, dairies, packing houses and other food processing plants has been developed by Goodyear Tire & Rubber Co., Akron, Ohio. Designated Style WH Creamery Hose, the new product is designed to operate at 175 pounds hot water pressure and to handle 40 pounds of saturated steam pressure up to 287°F., the company states. Available in ½, ¾, and 1 inch diameters, and 25 and 50 foot lengths, the new hose features a white neoprene cover designed to resist oils and acids.

Urethane Foam Pillow

► Style-Foam, a multi-celled urethane foam bed pillow cored with dozens of internal air pockets for freer circulation of air, has been introduced by Perma-Foam, Inc., Irvington, N. J. The air pockets, according to the company, add extra softness and resilience. The urethane pillow is also dustless, odorless, non-allergenic, and mildew- and vermin-proof. It may be hand-washed or steam sterilized in a commercial laundry, and comes in three sizes.

WIRE-IN-RUBBER

. . . problem solved

In the cross section of tire tread shown above, you see hundreds of tiny pieces of .006″ brass-plated, high-tensile, high-carbon steel wire. Cut to accurately measured lengths, the wire is molded into tire treads for added traction, better heat and static dissipation and longer life, for such applications as aircraft tires and other critical tire applications. The testing and manufacture of brass-plated, high-tensile wire with proper adhesion and strength was a National-Standard engineering contribution to the rubber industry. It is typical of the many National-Standard wire-in-rubber problem solutions. Call National-Standard for help in solving your wire-in-rubber problems.

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RUBBER TRENDS

by The Economist Intelligence Unit, Ltd.

RUBBER TRENDS is a quarterly bulletin for all those concerned with rubber, whether as a manufacturer, dealer or producer. The bulletin provides regular analysis of the main factors affecting the supply and consumption of both natural and synthetic rubber. **It does not duplicate information already available elsewhere; the emphasis throughout is on long term studies of rubber trends.**

RUBBER TRENDS is prepared and edited in London by *The Economist Intelligence Unit, Ltd.* Analysis and research in London are supplemented by reports from expert correspondents in the world's key consuming and producing areas. Associated with the famed London "Economist" the EIU is the largest international business and industrial research firm of its size and reputation serving major world markets.

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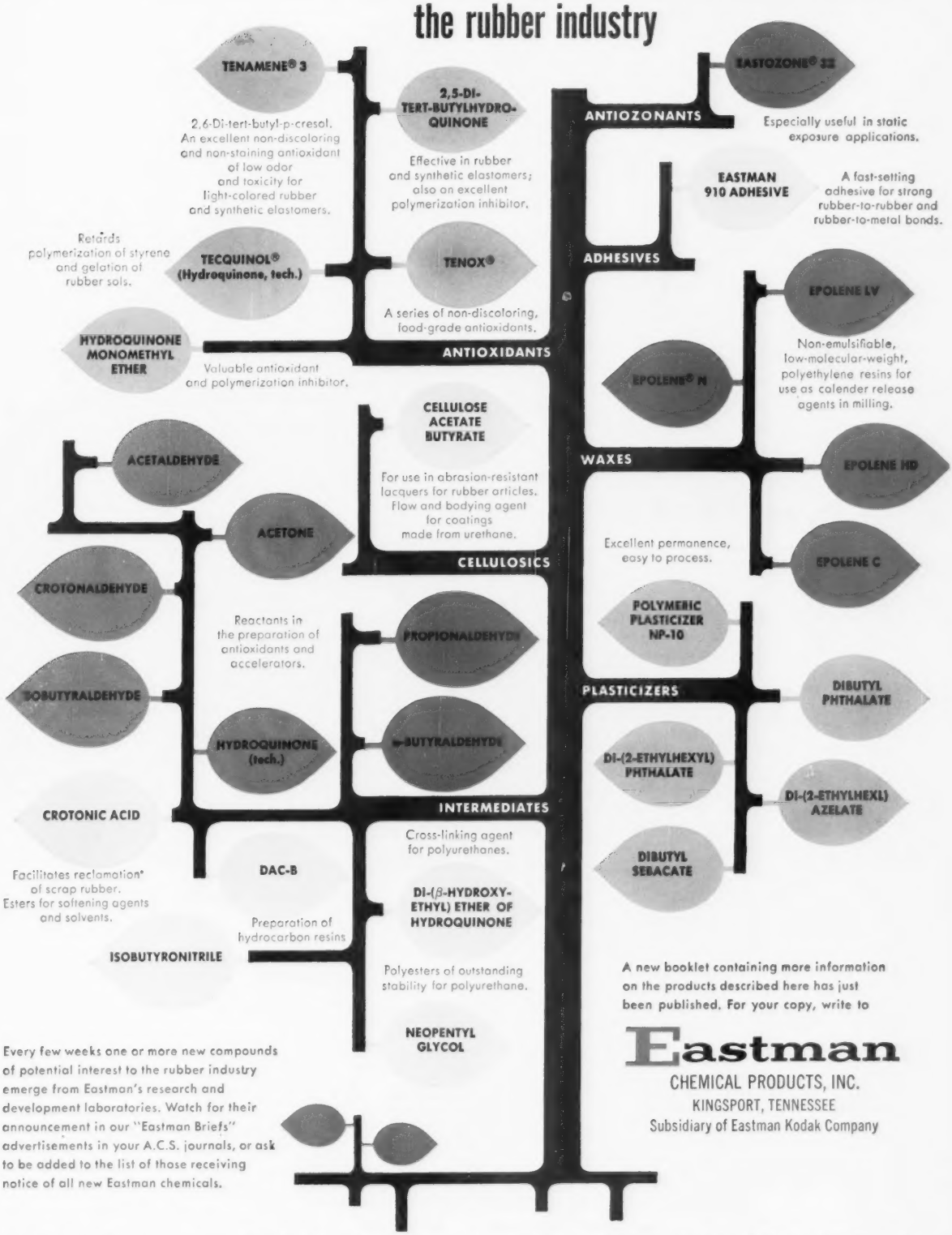

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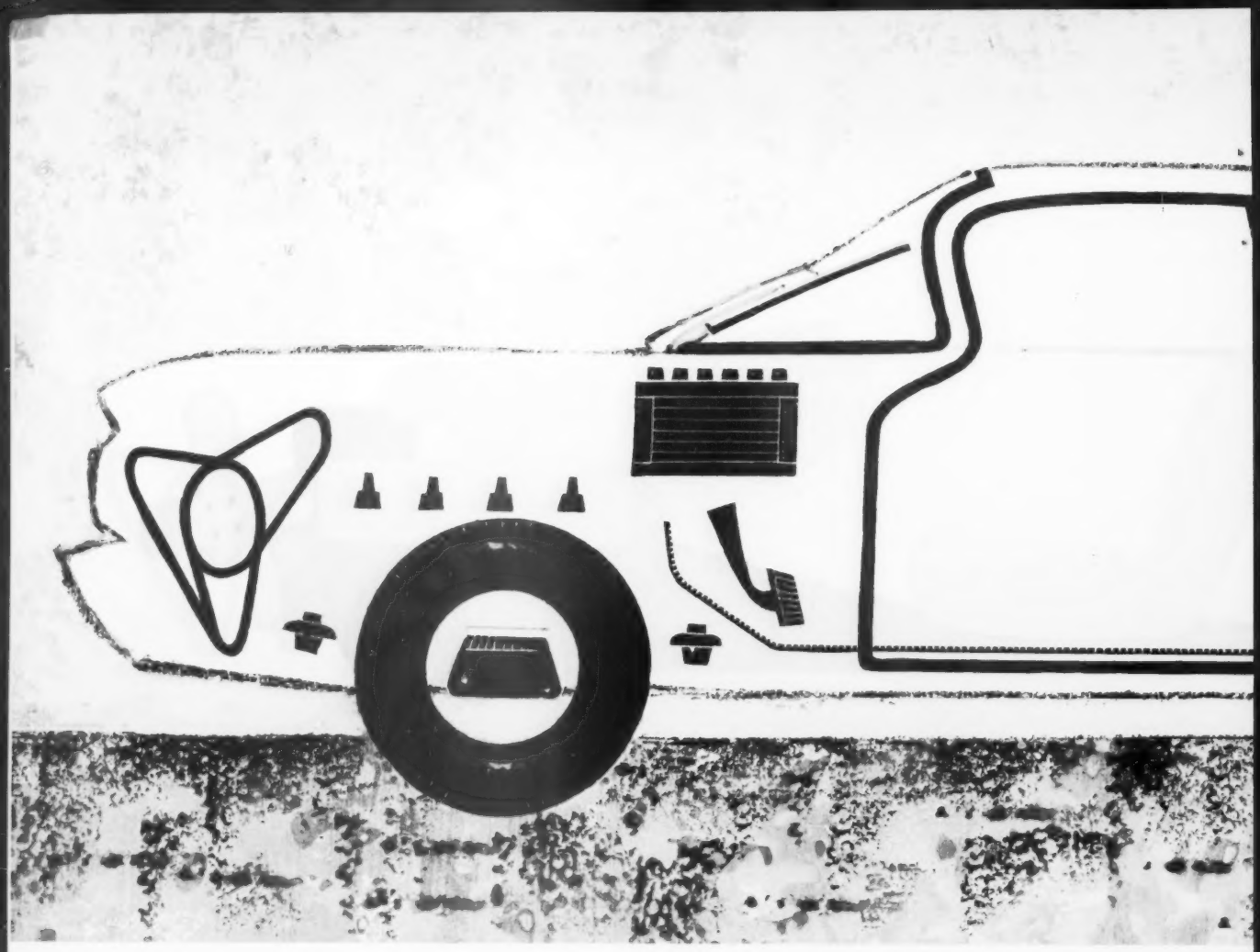

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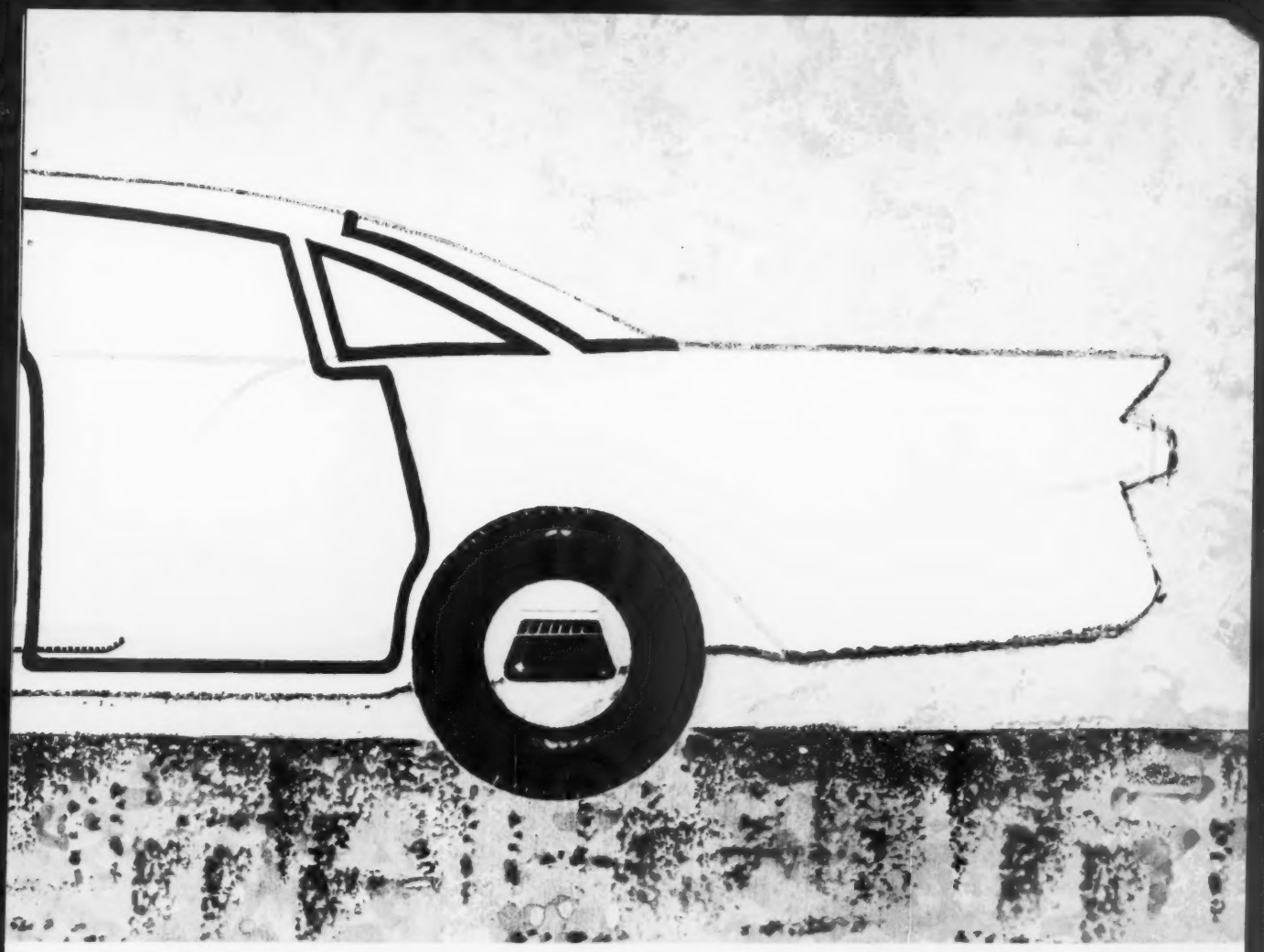

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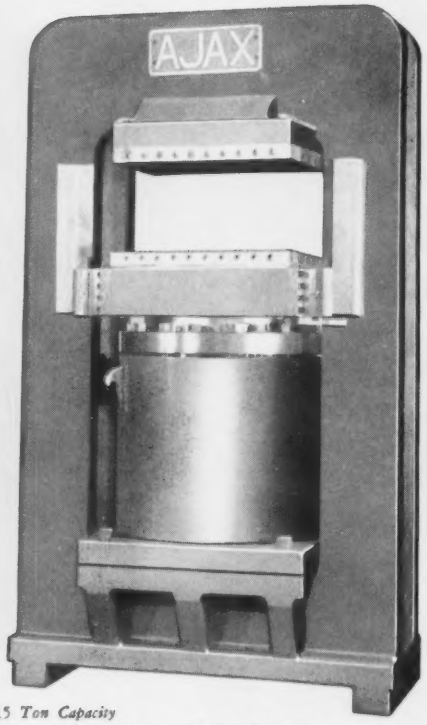

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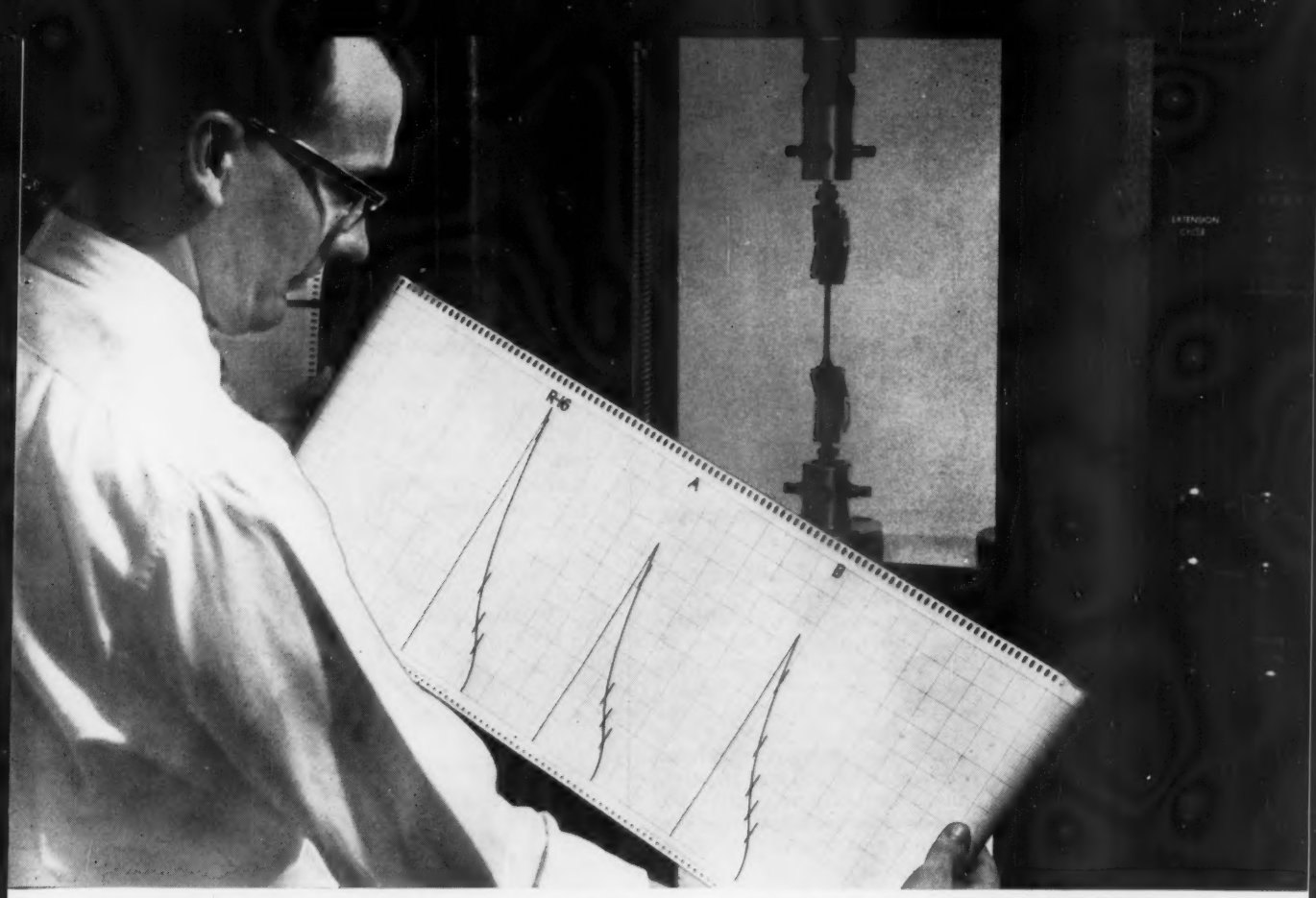

Dr. Stanley Jankowski, one of Neville's senior chemists, is shown here holding a test chart showing the results of tensile testing three aged rubber samples. The chart is just as it came from the Instron Tester, except that scribe lines have been inked over and labeled for visability in the picture. They have not been changed. From left to right, samples contained Neville's R-16 Coumarone-Indene Resin, competitive resin A and competitive resin B. Detailed results are shown below.

Competitive tensile test shows Neville Resin superior

Neville's R-16 Coumarone-Indene Resin was matched against two other leading resins in a neutral colored SBR test recipe compounded for comparative analysis. The results were as follows:

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Neville's R-16	1830 psi	1400 psi	76.5
Competitor A	1680 psi	1150 psi	68.5
Competitor B	1655 psi	1275 psi	77.2

Beyond superior tensile strength, there are other benefits derived from compounding rubber with R-16 Neville Resin. Elongation, both before and after aging, is exceptional and considerable aid to processing is enjoyed. Better mold flow and easier dispersion of fillers are also realized in using R-16 Neville Resin. Use the coupon to write for further information.

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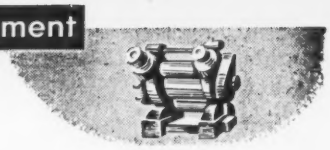
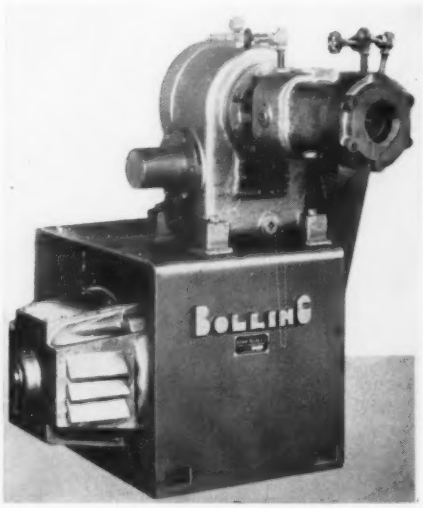


Stewart Bolling Extruder

► The motor/generator rubber extruder manufactured by Stewart Bolling & Co., Inc., Cleveland, Ohio, is housed in a filtered air metal cabinet. The worm is chrome-plated, hardened alloy steel and the circulating passage is drilled. Effective screw length is 15⅛ inches. The set has a



barrel cartridge of cast steel with spiral circulating passages fitted with centrifugally cast X-alloy liner. The barrel housing is cast iron. Nominal capacity up to 200 pounds per hour and a screw speed up to 60 r.p.m. are specified. A d.c. motor with a variable speed range of 8 to 1 is the most widely used type drive, according to the company, but other types of variable speed drive motors are offered.

Fisher Tensiometer

► Fisher Scientific Co., 407 Fisher Building, Pittsburgh 19, Penna., has developed a new compact tensiometer, Model 20, which is said to bring convenience to measurement of surface tension. The unit determines either surface or interfacial tension via the "ring" method in as little as 15 seconds, with a readability of ± 0.05 dyne, the company reports. According to the manufacturer, Model 20 brings a new high in convenience and accuracy to the measurement of surface and interfacial properties of serums, oils, inks, colloids and surface-active materials. The Fisher tensiometer consists of a wire torsion balance; a measuring dial (dynes per centimeter); a weighted platinum-iridium ring six centimeters in mean cir-

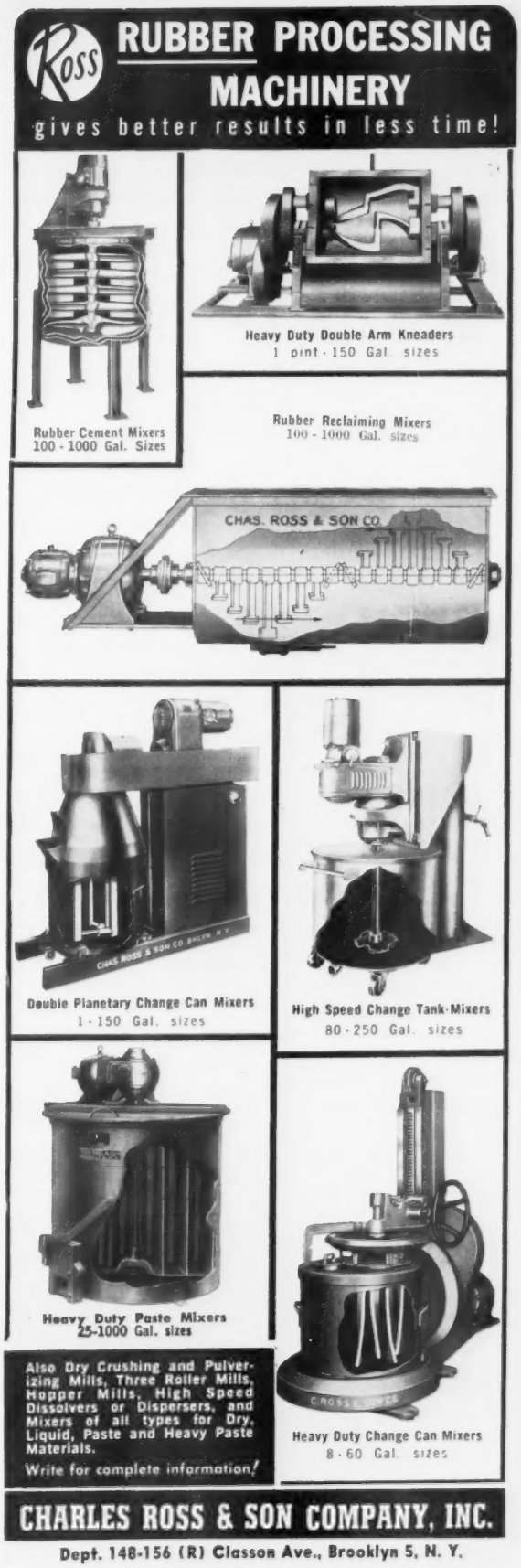
cumference; and a movable sample platform. The complete unit is housed in a case with carrying handle, leveling feet, spirit level, and hinged door with a secure magnetic catch. The torsion balance itself consists of a taut wire made of stainless steel for long life; lever arm; twisting mechanism (controlled by a spinner dial) for applying tension to the ring; a plastic dial; and a zero-adjust device. The dial, calibrated from 0 to 90 dynes per centimeter, is numbered in both directions—for reading either downward or upward forces.

Continuous Separator

► An automatic, universal continuous separator, which is said to represent a new development in high pressure centrifuging, has been developed by the Chemical Machinery Division of Baker Perkins, Inc., 1000 Hess, Saginaw, Mich. Designed and built of special steel to operate under 50 pounds internal pressure, the unit is the forerunner of other sizes for special applications, the company reports. It is particularly suitable for separation processes operating around —30°F., and applications in which construction metals containing nickel and copper must be avoided. The machine employs the "ter meer" principles of centrifuging, combining them with an automatically controlled system of pressurizing and depressurizing. The present unit, powered by a 15 hp motor, features an 18 inch diameter basket which is automatically charged and discharged, and an automatic leveling device for the cake. According to the manufacturer, an important construction feature is an arrangement for isolating the mechanical seal of the shaft so that it is not deflected with the deflections of the housing. The unit is equipped with electrical controls for automatic operation, but also is designed to be operated manually.

Denison Multipresses

► A new line of Series S hydraulic multipresses, in capacities from 3 to 8 tons, has been developed by Denison Engineering Division, American Brake Shoe Co., 1160 Dublin Road, Columbus 16, Ohio. The manufacturer states that the principal features of these self-contained, bench units are: a larger bed, more rigid frame, more knee room, and an easily accessible adjustable relief valve to give adjustment or ram pressure. The units have a pushbutton gage valve for quick pressure reading and longer gage life, a newly-designed cylinder for faster operating speeds, and a quick-adjusting inch and stroke change control. Built to JIC specifications, the multipresses are available with manual or automatic controls, and are designed for use with Denison 6 or 12 station indexing tables. Over-all height without bench is 49¼ inches; weight is approximately 1300 pounds.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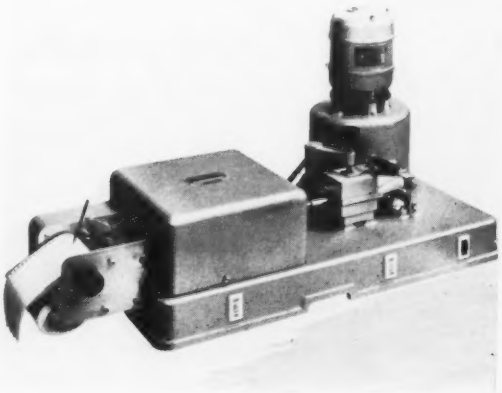
Atlas Hydraulic Presses

► Series 250, a new line of precision hydraulic presses designed for extremely accurate molding or laminating tolerances, has been announced by Atlas Hydraulics Division of Delaware Valley Manufacturing Co., Inc., Philadelphia, Penna. The presses are produced with an ultra-heavy-duty frame. According to the company, molding



tolerances can be accurately maintained on thin walls, long or deep draws, and tough or highly loaded compounds, and uniform flash points can be maintained throughout the entire platen area. The presses are built as complete self-contained units in small laboratory sizes from 12 x 12 inch platens to larger production sizes with 24 x 24 inch platens. Capacities range from 50 to 300 tons. Special characteristics or controls are available to suit individual requirements.

Velotron Low-Range Pyrometer

► Sensitivity at low temperatures, direct-reading charts and scales, interchangeable head units, and automatic ambient temperature compensation are some of the features of the new Velotron Low-Range Pyrometer System, developed by the Bristol Co., Waterbury 20, Conn. In operation, the pyrometer unit is sighted on the surface to be measured, by use of an eye-piece on the unit. The thermocouple output from the pyrometer unit is input to a Bristol Dynamaster instrument. The instrument automatically corrects for ambient temperature and records the corrected measurement. The Velotron system will measure temperatures in ranges from 0° to 200°F., up to 1100°F. It is especially applicable for temperature measurement, recording and control, with such products as rubber, synthetic rubber, tiles, roofing shingles, adhesives, cast aluminum, textiles, synthetic and natural fibres, paper, plastics, carpeting, mineral aggregates, chemical flows, petroleum flow, reactor kettles, furnace and oven charges, etc.

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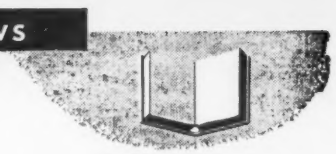
Reviews



S.O.P.H.I.A. By Pierre Boulle. Published by Vanguard Press, Inc., 424 Madison Ave., New York 17, N. Y. 5½ x 8½ in. 320 pp. $3.95.

Practically all manufacturers of rubber products have either a direct or academic interest in the natural rubber plantations in the Far East. Few such manufacturers ever have the opportunity to visit these plantations, but they have a general idea of what makes them tick. Very few rubber manufacturers, however, are fully acquainted with the multitude of specific operations called for in the operation of a large estate-owned plantation or with the chain of command required to supervise or oversee these specific operations. For such manufacturers, this book will be a revelation.

Written by the author of "The Bridge Over the River Kwai," this novel is rich in exotic background and tense with action set in Malaya. Like so many plantations in Malaya the one dealt with in this story is operated by a syndicate best known through its grouping of initials. The title of the book—"S.O.P.H.I.A."—is representative of the Society for the Overseas Promotion of Horticulture, Industry and Agriculture. In all, this organization operates some fifteen plantations in Malaya, all controlled through the "Agency." On these plantations live a score of isolated and lonely Europeans surrounded by Asiatic coolies. Some of them have their wives with them. All of them fight boredom.

In view of the fact that Pierre Boulle spent several years in Malaya as a rubber planter, it is not surprising that this novel is rich in rubber lore, even to the "special types of rubber" which every estate operator is constantly striving for. The book is strewn with technical and semi-technical rubber terms and the constant cry of "Stengah" is heard in every chapter. Mr. Boulle learned his work well during his stay in Malaya.

One does not have to be a member of the rubber industry to enjoy this novel. The author's masterly storytelling ability is evident on every page, as is his disciplined intellect, his clarity of style, and, most important, is his concern with the moral conflicts between personal and professional loyalties in today's turbulent society. It is this society which Mr. Boulle probes deftly and keenly.

•

Crushing and Grinding. A Bibliography. Published by Chemical Publishing Co., Inc., 212 Fifth Avenue, New York. 6 x 9¼ in. 425 pp. $10.50.

This important book, the only one of its kind, has been designed to help chemical engineers, chemists, technicians, and manufacturers in solving their problems and increasing the efficiency of crushing and grinding operations in their plants.

Divided into two main sections, the first consists of short reviews and the second is the bibliography proper. Reviews are written by an expert in the field on the most important aspects of crushing and grinding raw materials for various chemical industries.

The principal part of the book includes abstracts with annotations of 2,800 articles and books published from 1920 up till now. All phases of crushing and grinding are included: theoretical aspects, operation techniques, many types of equipment used and their efficiency, raw materials that are crushed or ground, particle size and surface area determination, and industrial hazards and their elimination. Rubber scientists will find entries on rubber lined mills particularly interesting, including "Solid Rubber Construction in New Ball Mill," "A New

Rubber Ball Mill," "Increasing the Efficiency of Fine Grinding," "Enamel Milling," "Rubber Linings for Grinding Mills," "Practical Dissertation on Pebble Mills," "Rubber as Lining for Grinding Mills," "Rubber Linings for Ball Mills," and "Grinding and Sifting."

•

The Technique and Practice of Costing for the Rubber Manufacturing Industry. Prepared by the Accountants' Committee. Published by the Federation of British Rubber and Allied Manufacturers, 43 Bedford Square, London, W.C. 1, England. 2nd edition, cloth. 9¼ x 5½ in. 66 pp. 15/—.

The distinctive feature of this handbook is the final section, which applies in detail the system of budgetry control and standard costs outlined in the earlier chapters to the particular case of an imaginary rubber company, and shows how by this means the cause of losses previously unsuspected can be brought into the open and effectively controlled.

The first edition, compiled by the Accountants' Committee of the Federation and published in November 1954, was so well received by the rubber industry and by accountants generally, both in Great Britain and overseas, that it was already out of print by the end of 1957. The second edition has been completely revised by the original authors, details brought up-to-date, and new illustrative tables added to the chapter of examples.

BOOKLETS, CATALOGS, etc.

Silicones in Aircraft and Missiles. Dow Corning Corp., Midland, Mich. 8½ x 11 in. 8 pp.

"Silicones Solve Space Age Problems" is the theme of a new eight-page booklet which describes a few of the many established applications for silicones in military and commercial aircraft, in missiles, and in ground support systems. The importance silicones have attained in the air travel field is demonstrated by the more than 25 applications that are detailed and illustrated in this comprehensive brochure. Reasons why silicones have become such basic and vital materials are also outlined in this reference which covers such silicone products as fluids, rubber, potting materials, sealants, and protective coatings.

•

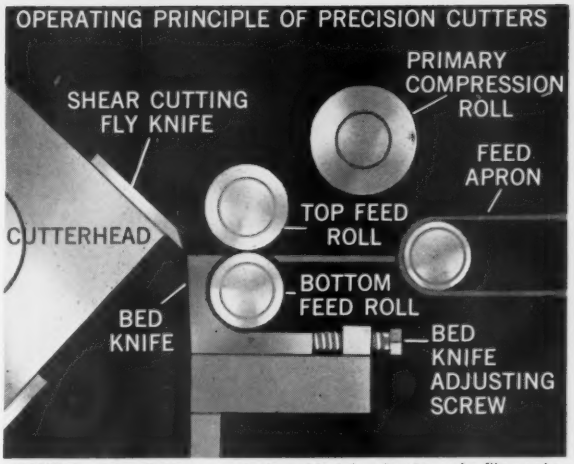
Porous Teflon and Kel-F. (Bulletin P-103). Pall Corp., 30 Sea Cliff Avenue, Glen Cove, N. Y. 8½ x 11 in. 4 pp.

In describing porous Teflon and porous Kel-F, the bulletin lists standard forms, such as discs and sheets, which are fabricated from these chemically inert filter media. Complete specifications of standard materials include: porosity, mechanical properties, chemical resistance, flow capacity and standard thickness. Features of the Surfamax all-purpose industrial filter with a Teflon or Kel-F filter medium are described. In addition, a woven Teflon cloth, CPS, is indicated as being useful for all filtration and dust bag collection systems. The bulletin lists standard discs and sheet sizes, and includes process.

•

Fluorosilicone Rubber. (Code 9-113). Dow Corning Corp., Midland, Mich. 8½ x 11 in. 4 pp.

This new brochure contains all the facts on Silastic LS, the Dow Corning fluorosilicone rubber. Illustrations show Silastic LS at work as a lip seal in a radar scanner and a flexible fuel line coupling in a jet airplane. Graphs show the performance of Silastic LS during oven agings and ASTM oil exposure tests. Typical properties and practical tables suggest when to use Silastic LS for applications requiring solvent, fuel, oil and fluid, and chemical resistance.



GIANT Precision Cutters are designed to take sheets, rods, filaments, or other materials that are long enough and uniform enough to be held firmly between top and bottom feed rolls in sketch above. In Taylor-Stiles Series 100 and Series 200 Cutters, the holding line or "pinch" is close to the point of cutting, where the fly knives meet the bed knife, thus insuring precise length of cut.

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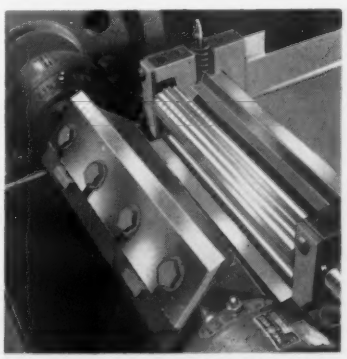
FIG. G-117

Fig. G-117 shows a No. 115 Cutter with all guards removed. Stock enters on the feed apron, passes under a primary compression roll, then passes between the pair of feed rolls (bottom roll not visible), then across the top of the bed knife where the fly knives in the head make the shearing cut.



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Mineral Extenders for Urethane Foams. (Bulletin TI-260). Minerals & Chemicals Corp. of America, Essex Turnpike, Menlo Park, N. J. 8½ x 11 in. 8 pp.

The reduction of urethane foam costs and the modification of foam properties through the use of an inert mineral extender is the subject of this technical bulletin. The report, based on the results of 4 years of extensive laboratory investigation, describes how the resin portion of all types of foams, including prepolymer flexible foams, one-shot flexible foams, and quasi-prepolymer and one-shot rigid foams can be successfully extended by adding aluminum silicate extenders in the ingredients before foaming. The bulletin includes formulas, comparisons of various properties, and cost data. Many test results are shown graphically. A table describes the various extenders found to be effective as polyurethane foam extenders and their effect upon the finished product.

•

Polysulfide Crude Rubber. (CS-2.) Thiokol Chemical Corp., 780 North Clinton Avenue, Trenton 7, N. J. 8½ x 11 in. 8 pp.

Specific data on the resistance of polysulfide crude rubber to ozone attack is given in this new Thiokol bulletin. Charts, graphs and conclusions in the bulletin are the results of a recent Thiokol study which proves the outstanding ozone resistance of polysulfide rubber compounds now being used for hose coverings, fuel cells, molded parts and diaphragms. The data indicates the ozone resistance of polysulfide rubber Types FA, ST and the recently developed ZR-300 with and without the aid of compounding additives.

•

An Engineering Guide to the DuPont Elastomers. Elastomer Chemicals Department, E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 8½ x 11 in. 18 pp.

The booklet contains pertinent data on DuPont's elastomers, Neoprene, Viton, Hypalon, and Adiprene L. One section is devoted to the comparative properties of DuPont's four elastomers with natural and other synthetic rubbers. Also included in the booklet are sections describing the important design properties of the DuPont elastomers. The chemical resistance of Neoprene, Hypalon and Viton is presented in table form.

•

Acetonitrile. Sohio Chemical Co., Fort Amanda Road, Lima, Ohio. 8½ x 11 in. 56 pp.

This guide, a complete source for acetonitrile information, contains reactions, physical properties, information on specific uses, and a bibliography containing 134 references. Some of the applications mentioned are: agriculture, petroleum processing, synthetic fibers, surface coatings, chemical manufacturing, water softeners, plasticizer, adhesives, fats and oil processing, separation of tall-oil acids, extraction of naphthenic acids, and chlorosilanes. The guide is suggested as a useful tool for any research and development worker.

•

Bostik Clear Urethane Coatings. (File 1-60). B. B. Chemical Co., 784 Memorial Drive, Cambridge, Mass. 8¾ x 11½ in. 4 pp.

A series of twelve clear urethane coatings are covered in this information file, and a chart provides general, physical, chemical and mechanical properties for each of the twelve. The chart shows the twelve coatings in four basic classes of formulations. Suggested applications and maintenance uses are featured.

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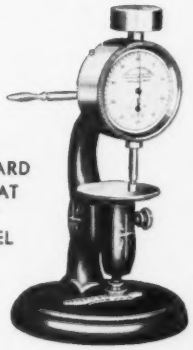

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FOOT DIAMETERS
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ROLLS
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RANGE
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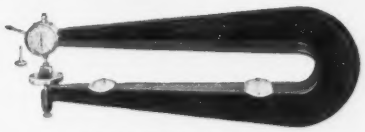

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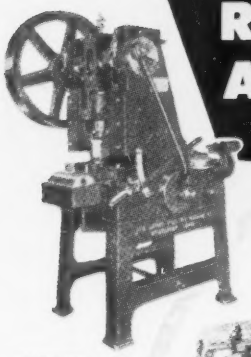
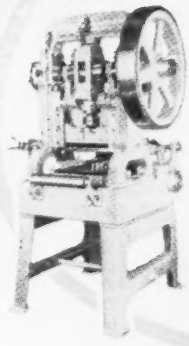
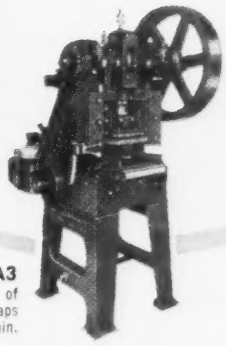


MODEL A1
Precision cutting for both high speed production or short runs.



MODEL A2
Precision cutting for multiple heels, half and full soles with stock grain.



MODEL A3
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TRENDS
NEWS
PRICES

Natural Rubber

The price of natural rubber on the New York Commodity Exchange moved in a range of 341 points since our last report (October 1), high for the period being 35.63c reached on October 7, and low being 32.25c reached on October 31. The average price of spot rubber in October was 34.06c based on 21 trading days. This compares with an average of 35.04c in September.

According to analysts at Merrill Lynch, Pierce, Fenner and Smith, surplus projections appear likely to be realized. Ever since the Rubber Study Group announced its surplus estimate for 1960, many in the trade have taken issue with the 145,000 ton figure. As time passes, however, some reappraising the situation are coming around to the Study Group's point of view. Differences now seem to center around the amount rather than the possibility of a surplus.

Possibly influencing this way of thinking are the September Singapore stock figures. They show September stocks up 14,000 long tons from August and 18,500 long tons in excess of last year.

Although most of this stock is held by leading shippers, who are trying to support the market, prices sagged into new low ground. Whenever this influential buying became evident, sellers withdrew temporarily thereby giving the market an appearance of strength. However, none of the recent rallies could be sustained, not even through the "gold rush" which temporarily steadied prices in other sensitive commodities.

Foreign Offtake

Foreign offtake has been slow; world demand for rubber is not in excess of supplies. Users seem confident of getting rubber when they need it. Also, the U.K. and U.S. stockpiles can fill such gaps as may occcur. U.S. economic uncertainties, in the automobile sector, are not conductive to encouragement of rubber purchasing. This does not concern the U.S. auto industry only. On the Continent and in the U.K. auto output is being cut back because of reduced export demand. Thus demand for rubber in the auto industries of the world is slackening off with no noticeable replacement by demand from other sources.

Natural rubber production kept pace with consumption in July at 155,000 tons. Stocks at the end of the period at 670,000 tons were some 15,000 tons lower than in January. Output of synthetic continued to run ahead of consumption. Provisional figures from the International Rubber Study Group showed deliveries from British and U. S. stockpiles were 11,700 tons in July and consumption in the month included estimated imports by Soviet Russia of 13,00 long tons and Communist China of 12,000 tons.

NEW YORK, NOVEMBER 1, 1960

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM OCT. 1 TO OCT. 31

Oct.	Spot	Nov.	Jan.	Mar.	Sales
1	....	....	....	....	...
2	....	....	....	....	...
3	35.50	34.75	33.60	33.00	26
4	35.25	34.65	33.35	32.75	21
5	35.50	35.00	33.70	33.25	41
6	35.25	34.60	33.45	33.00	76
7	35.63	34.10	32.76	32.31	132
8	....	....	....	....	...
9	....	....	....	....	...
10	34.38	34.15	32.80	32.20	65
11	34.25	33.95	32.55	32.10	30
12	34.75	34.35	32.85	32.30	35
13	34.50	34.20	32.90	32.20	3
14	34.50	34.00	32.60	32.15	29
15	....	....	....	....	...
16	....	....	....	....	...
17	34.00	33.55	32.25	31.90	52
18	33.75	33.75	32.50	32.00	23
19	33.75	33.75	32.50	32.10	52
20	34.00	33.93	32.82	32.25	76
21	33.75	33.85	32.75	32.30	43
22	....	....	....	....	...
23	....	....	....	....	...
24	33.25	33.45	32.40	32.00	54
25	33.00	33.25	32.10	31.75	31
26	32.75	32.75	31.75	31.40	78
27	32.75	32.60	31.65	31.45	31
28	32.50	32.45	31.55	31.30	53
29	....	....	....	....	...
30	....	....	....	....	...
31	32.25	32.10	31.06	30.90	179

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.32¼
Nov.	.32
Dec.	.31½
Thin Latex Crepe:	
Spot	.33¾
Thin Brown Crepe, No. 2	.28
Flat Bark Crepe	.22½

London Market
(Standard Smoked Sheets)

Dec.	31.10 — 31.24
Jan.-Mar.	31.10 — 31.24

Singapore Market
(Standard Smoked Sheets)

Dec.	29.31 — 29.39

Middling Upland Quotations

	Sept. 30	Oct. 31		
	Close	High	Low	Close
Dec.	31.85	31.51	31.48	31.50
Mar.	32.90	32.02	31.98	31.99
May	32.90	32.32	32.31	32.33

Notes & Quotes

The Free World must recognize it is at war in the economic field and must mobilize its economic assets, Harvery S. Firestone, Jr., chairman of the Firestone Tire & Rubber Co., declared recently. "If any nation or combination of nations aspires to world domination, success can come only by economic warfare rather than by military hardware," Mr. Firestone stated. He charged private investors to provide the developing nations of the world with ample help.

Synthetic Rubber

By 1965 the relationship between synthetic rubber production capacity and the world demand for synthetic is expected to take on a new aspect, with production capacity definitely exceeding consumption—by 20 to 22 per cent, it has been predicted. This is the problem foreseen by Dr. J. D. D'Ianni, assistant to the vice-president in charge of research and development, Goodyear Tire and Rubber Co., Akron, Ohio.

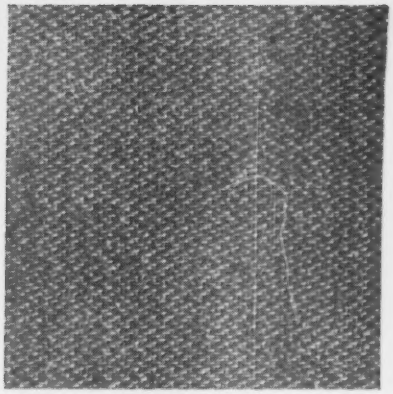
By 1965, world wide capacity for production is expected to rise from 2.8 to 4.3 million tons—an increase which even growing demand will not be able to match. Dr. D'Ianni, moreover, also foresees a dropping export rate of synthetic for this country — down from an all-time high of 300,000 long tons in 1960, to about 225,000 long tons by 1965—due to a boom in foreign production.

Foreign Capacity

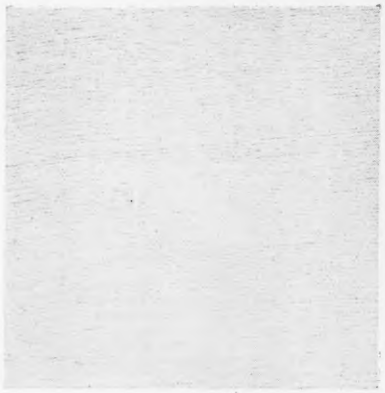
West Europe, India, Japan, Australia, South Africa, Mexico and South America all will contribute to the 4.3 million ton figure. Countries behind the Iron Curtain are also expected to play their part in the booming world production capacity figures. "Plants currently in production in the U. S. S. R., East Germany and Poland are estimated from published reports to have a capacity of 626,000 tons a year. With the addition of plants in China, Czechoslovakia and Rumania, total capacity behind the Iron Curtain by 1965 is estimated to reach a total of 975,000 tons a year."

In the meantime, production and demand for synthetic continue their rise in this country with Goodyear announcing a $1.25 million expansion of facilities for the production of its Chemigum (nitrile) rubber and synthetic latices, necessitated, the company reports, by increasing demands of the textile industry.

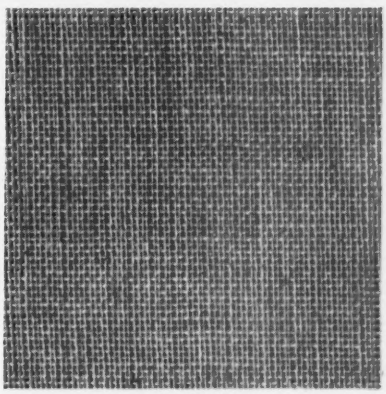
As far as the future is concerned, new developments and competition of synthetic with natural rubber will, it is to be expected, make their contribution to growing synthetic production, as evidenced by Goodyear's production plans for a new "natural-synthetic" rubber which will be able to compete favorably with rising prices of natural rubber. Dr. Ray P. Dinsmore, vice-president in charge of research and development at Goodyear, reports that the rubber industry anticipates that the new synthetic, which duplicates the natural rubber molecule, will sell for a time at 30c a pound, but he then went on to say: "But producers must be prepared to meet natural rubber competition at 25c a pound or less." According to Dr. Dinsmore, American plants thus far announced for construction are expected to produce a minimum of 200,00 long tons of the new rubber annually by 1963. European plants already in the planning stages will have a production capacity of 100,000 long tons by 1963, he said.



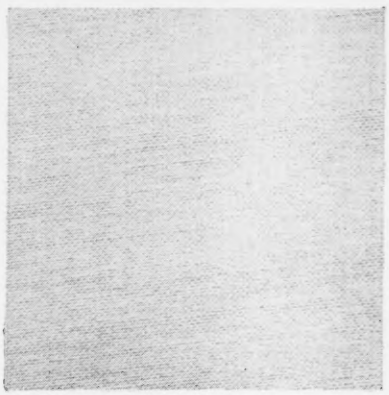
Cotton Broken Twill



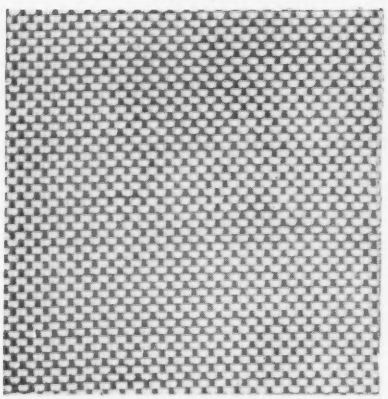
Spun Dynel



Cotton Chafer

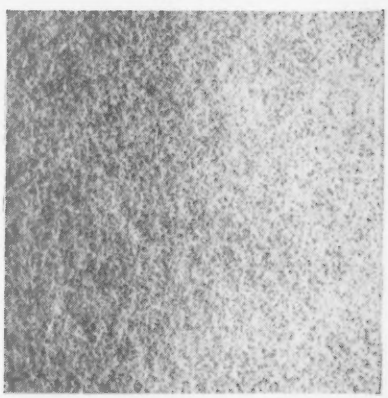


Spun Rayon



Welkote Filament Nylon

Knit Kote



Lantuck

Shown here is just a tiny sample of the many quality base fabrics offered by Wellington Sears for both plastic and rubber coating. The entire selection is more complete and up-to-the-minute than can be found anywhere else in the textile industry.

There are wovens, non-wovens and knits in cotton and synthetics for every coating application. All are continuously proving themselves—in a variety of uses ranging from air-supported domes and collapsible fuel tanks to luggage, upholstery and garments.

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PRICES OF COMMERCIALLY AVAILABLE

Dry Rubber

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene NF	.4900
Butaprene NH	.6500
Butaprene NL	.5000
Butaprene NXM	.5800
Chemigum N3NS and N5	.5800
Chemigum N6	.5000
Chemigum N6B	.5000
Chemigum N7	.5000
Chemigum N8	.5000
Chemigum N600	.5000
Herecol N-33	.6800
Hycar 1001 and 1041	.5800
Hycar 1002	.5000
Hycar 1014	.6000
Hycar 1042 and 1043	.5000
Hycar 1051	.5800
Hycar 1052	.5000
Hycar 1053	.5000
Hycar 1072	.6400
Hycar 1203	.4600
Hycar 1312	.5000
Hycar 1411	.6200
Hycar 1432	.5900
Hycar 1441	.6200
Paracril Aj	.4850
Paracril B and BJ	.5000
Paracril BLT and BJLT	.5000
Paracril C and CLT	.5800
Paracril CV	.6300
Paracril D	.6500
Paracril 18-80	.6000
Paracril OZO	.4600
Polysar Krynac 800	.5000
Polysar Krynac 801	.5800
Polysar Krynac 802	.5000
Polysar Krynac 803	.5000

Butadiene-Styrene Types

Ameripol 1000	.2410
Ameripol 1001	.2410
Ameripol 1002	.2435
Ameripol 1006	.2410
Ameripol 1006 (crumb)	.2475
Ameripol 1007	.2410
Ameripol 1009	.2475
Ameripol 1009 (crumb)	.2590
Ameripol 1011	.2475
Ameripol 1012	.2425
Ameripol 1012 (crumb)	.2490
Ameripol 1013	.2410
Ameripol 1013 (crumb)	.2615
Ameripol 1500 and 1501	.2410
Ameripol 1502	.2410
Ameripol 1605	.1900
Ameripol 1703	.2060
Ameripol 1705	.2035
Ameripol 1707	.1910
Ameripol 1708	.1910
Ameripol 1710	.1885
Ameripol 1712	.1885
Ameripol 1805	.1550
Ameripol 1808	.1480
Ameripol 1809	.1545
Ameripol 1810	.1400
Ameripol 4600	.2410
Ameripol 4601	.2410
Ameripol 4651	.1770
Ameripol 4659	.1820
Ameripol 4660	.1870
Ameripol 4664	.1845
Ameripol 4667	.2080
Ameripol 4700	.1750
Ameripol 4756	.1545
Ameripol 4758	.1450
Ameripol 4759	.1598
Ameripol 4760	.1576
Ameripol 4761	.1710
ASRC 1000	.2410
ASRC 1001 and 1004	.2410
ASRC 1006	.2410
ASRC 1009	.2475
ASRC 1018	.2700
ASRC 1019	.2650
ASRC 1500	.2410
ASRC 1502	.2410
ASRC 1503	.2625
ASRC 1703	.2060
ASRC 1708	.1910
ASRC 1712	.1885
ASRC 1713	.1750
ASRC 3105 and 3106	.2410
ASRC 3110	.2600
Baytown B-129	.1960
Baytown B-134	.1900
Baytown B-172	.1825
Baytown 1600	.1930
Baytown 1601	.1930
Baytown 1602	.1930
Baytown 1801	.1760
Baytown 1803	.1740
Baytown 1811	.1569
Baytown 8675	.1820
Baytown 8676	.1876
Baytown 8677	.1820
Baytown 8678	.2080
Baytown 8679	.2022
Baytown 8680	.1775
Baytown 8681	.1835
Baytown 8775	.1545
Baytown 8776	.1679
Baytown 8777	.1550
Baytown 8778	.1480
Baytown 8779	.1496
Baytown 8780	.1507
Baytown 8781	.1655
Baytown 8782	.1583
Baytown 8783	.1515
C-102 (Shell)	.2300
Carbomix 3750	.1820
Carbomix 3751	.1545
Carbomix 3752	.1845
Carbomix 3753	.1640
Carbomix 3756	.1569
Carbomix 3757	.1480
Carbomix 3758	.1545
Carbomix 3760	.1496
CB-102 (Shell)	.1850
Copo 1006	.2410
Copo 1500	.2410
Copo 1502	.2410
Copo 1505-NS	.2610
Copo 1507	.2410
Copo 1712	.1885
Copo 1713	.1750
Copo 1714	.1725
Copo 1773	.2060
Copo 1778	.1910
Copo 2000	.2775
Copo 3700	.1725
Copo 3701	.1750
Copo 3900	.2310
FR-S 146	.2410
FR-S 158	.3000
FR-S 173	.2060
FR-S 178	.1910
FR-S 181 and 182	.2410
FR-S 184	.1885
FR-S 1000	.2410
FR-S 1001	.1410
FR-S 1004 and 1006	.2410
FR-S 1007	.2410
FR-S 1009	.2475
FR-S 1010	.2600
FR-S 1012	.2425
FR-S 1013	.2410
FR-S 1014	.2810
FR-S 1500 and 1502	.2410
FR-S 1703	.2060
FR-S 1710 and 1712	.1885
Gentro 1500	.2410
Gentro 1712	.1885
Gentro-Jet 9152	.2080
Gentro-Jet 9153	.1820
Gentro-Jet 9154	.1845
Gentro-Jet 9250	.1580
Gentro-Jet 9251	.1640
Gentro-Jet 9252	.1670
Gentro-Jet 9275	.1500
Naugapol 1016	.2650
Naugapol 1018	.2700
Naugapol 1019	.2650
Naugapol 1022	.2950
Naugapol 1023	.3150
Naugapol 1503	.2625
Naugapol 1504	.0330
Naugapol 6003	.2700
Naugapol 6100	.3100
OB-102 (Shell)	.1825
OB-104 (Shell)	.1475
OB-106 (Shell)	.1510
OB-110 (Shell)	.1410
OB-111 (Shell)	.1540
OB-113C (Shell)	.1750
OB-114C (Shell)	.1420
OB-116 (Shell)	.1810
Philprene 1000	.2410
Philprene 1006	.2410
Philprene 1009	.2475
Philprene 1018	.2700
Philprene 1019	.2650
Philprene 1500 and 1502	.2410
Philprene 1503	.2625
Philprene 1601	.1930
Philprene 1603	.1960
Philprene 1605	.1900
Philprene 1606	.1820
Philprene 1608	.1845
Philprene 1609	.2080
Philprene 1703	.2060
Philprene 1708	.1910
Philprene 1712	.1885
Philprene 1803	.1740
Philprene 1805	.1550
Philprene 1808	.1480
Plioflex 1006	.2410
Plioflex 1500C	.2410
Plioflex 1502	.2410
Plioflex 1507	.2410
Plioflex 1508	.2410
Plioflex 1510	.2410
Plioflex 1710C and 1712C	.1885
Plioflex 1713	.1750
Plioflex 1714C	.1725
Plioflex 1773	.2060
Plioflex 1778	.1910
Polysar Kryflex 200	.2510
Polysar Krylene	.2410
Polysar Krylene NS	.2410
Polysar Krynol 651	.1885
Polysar Krynol 652	.1910
Polysar S-630	.2410
Polysar S-X 371	.2550
Polysar SS-250	.2875
S-1000	.2300
S-1002	.2325
S-1006	.2300
S-1009	.2400
S-1011	.2325
S-1013	.2300
S-1500	.2300
S-1502	.2300
S-1509	.2300
S-1600	.1825
S-1602	.1825
S-1604	.1825
S-1605	.1800
S-1606	.1750
S-1607	.1750
S-1703	.1950
S-1707	.1800
S-1709	.1775
S-1710	.1775
S-1712	.1775
S-1778	.1800
S-1800	.1475
S-1802	.1410
S-1803	.1650
S-1804	.1750
S-1806	.1510
S-1807	.1540
S-1808	.1420
S-7652	.1875
S-7701	.1850
SP-103 (Shell)	.2900
Synpol 1000 and 1001	.2410
Synpol 1002	.2435
Synpol 1006	.2410
Synpol 1007	.2410
Synpol 1009	.2475
Synpol 1012	.2425
Synpol 1013	.2410
Synpol 1061	.2410
Synpol 1500	.2410
Synpol 1502	.2410
Synpol 1551	.2410
Synpol 1703	.2060
Synpol 1707	.1910
Synpol 1708	.1910
Synpol 1712	.1885
Synpol 8102	.2401
Synpol 8151	.1820
Synpol 8152	.1860
Synpol 8200	.1910
Synpol 8201	.1750
Synpol 8202	.1725
Synpol 8208	.1750
Synpol 8255	.1480
Synpol 8253	.1584
Synpol 8254	.1545
Synpol 8266	.1598
Synpol 8267	.1640

Butyl Rubbers

Enjay Butyl 035 and 150	.2300
Enjay Butyl 165 NS	.2400
Enjay Butyl 215	.2300
Enjay Butyl 217	.2300
Enjay Butyl 218	.2300
Enjay Butyl 268 NS	.2400
Enjay Butyl 325	.2300
Enjay Butyl 365 NS	.2400
Polysar Butyl 100	.2450
Polysar Butyl 101	.2775
Polysar Butyl 200 and 300	.2450
Polysar Butyl 301	.2550
Polysar Butyl 400	.2450

SYNTHETIC RUBBER POLYMERS

Chlorosulfonated Polyethylene

Hypalon 20	.4700 [3]
Hypalon 30	.6000 [3]
Hypalon 40	.5000 [3]

Fluoroelastomers

Kel-F Fluorel	$15.00 [3]
Kel-F 3700 and 5500	$16.00 [3]
Vitron A and A-HV	$10.00 [3]
Viton B	$13.00 [3]

Neoprene

	(prices l.c.l.)
Neoprene Types AC and CG	.5500 [3]
Neoprene Type AD	.5500 [3]
Neoprene Type FB	.6500 [3]
Neoprene Type GN	.4100 [3]
Neoprene Type GN-A	.4100 [3]
Neoprene Type GRT	.4200 [3]
Neoprene Type KNR	.7500 [3]
Neoprene Type S	.4200 [3]
Neoprene Type W	.3900 [3]
Neoprene Type WB	.4100 [3]
Neoprene Type WHV	.3900 [3]
Neoprene Type WRT	.4500 [3]
Neoprene Type WX	.4100 [3]

Polysulfide Rubbers

	(prices l.c.l.)
Thiokol Type A	.5000 [3]
Thiokol Type FA	.6900 [3]
Thiokol Type ST	1.2500 [3]

Silicone Rubbers*

	(prices l.c.l.)
GE (compounded)	2.50 [3]
GE Silicone Gum (not compounded)	4.00 [3]
Silastic (compounded)	2.56 [3]
Silastic (gums)	4.00 [3]
Union Carbide (gums)	4.00 [3]
Union Carbide (compounds)	2.50 [3]

Latex

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600 [1]
Butaprene N-400 and N-401	.5400 [1]
Chemigum 200	.4800 [3]
Chemigum 235	.5300 [3]
Chemigum 236	.5300 [3]
Chemigum 245	.4500 [3]
Chemigum 246	.4500 [3]
Chemigum 247	.4500 [3]
Chemigum 248	.4500 [3]
Hycar 1512	.4500 [3]
Hycar 1551	.5300 [3]
Hycar 1552	.4500 [3]
Hycar 1561	.5300 [3]
Hycar 1562	.4500 [3]
Hycar 1571	.5300 [3]
Hycar 1572	.4500 [3]
Hycar 1577	.4500 [3]
Nitrex 2612	.4500 [1]
Nitrex 2616	.5300 [1]
Nitrex 2620	.4500 [1]
Nitrex 2625	.4500 [1]
Tylac 640	.4500 [1]
Tylac 740	.4900 [1]
Tylac 840	.5300 [1]
Tylac 1640	.5400 [1]
Tylac 2241	.5300 [1]
Tylac 2430	.5000 [1]
Tylac 2570	.5300 [1]
Tylac 2830	.4500 [1]

Butadiene-Styrene Types

CL-101 (Shell)	.2800 [3]
Copo 2000	.2775 [3]
Copo 2101	.3000 [3]
Copo 2102	.3200 [3]
Copo 2105	.3200 [3]
Copo 2108	.3000 [3]
Copo 2109	.2775 [3]
Copo 2110	.3200 [3]
Copo 3852	.3000 [3]
FR-S 110	.3000 [3]
FR-S 150	.3000 [3]
FR-S 151	.2900 [3]
FR-S 174	.2950 [3]
FR-S 176	.2775 [3]
FR-S 2000	.2775 [3]
FR-S 2001	.2775 [3]
FR-S 2002	.3000 [3]
FR-S 2003	.3050 [3]
FR-S 2004	.3050 [3]
FR-S 2006	.2900 [3]
FR-S 2105	.3200 [3]
Naugatex 2000	.2775 [1]
Naugatex 2001	.2775 [1]
Naugatex 2002	.3000 [1]
Naugatex 2006	.2900 [1]
Naugatex 2105	.3200 [1]
Naugatex 2107	.3200 [1]
Naugatex 2108	.3000 [1]
Naugatex 2113	.2900 [1]
Naugatex J-8174	.3200 [1]
Naugatex J-8535	.3000 [1]
Pliolite 2000	.2775 [3]
Pliolite 2001	.2775 [3]
Pliolite 2076	.2900 [3]
Pliolite 2104	.3200 [3]
Pliolite 2105	.3200 [3]
Pliolite 2107	.3200 [3]
Pliolite 2108	.3000 [3]
S-2000 and S-2006	.2600 [3]
S-2101	.2600 [3]
S-2105	.2800 [3]
S-2108	.2900 [3]
Tylac 3040	.3200 [1]
Tylac 3500	.2950 [1]
Tylac 400	.3000 [1]
Tylac 410	.2900 [1]
Tylac 450A	.2775 [1]

Neoprene

Neoprene Latex 60	.4000 [3]
Neoprene Latex 571	.3700 [3]
Neoprene Latex 572	.3900 [3]
Neoprene Latex 601-A	.4000 [3]
Neoprene Latex 673	.5000 [3]
Neoprene Latex 735	.3800 [3]
Neoprene Latex 736	.3800 [3]
Neoprene Latex 842-A	.3700 [3]
Neoprene Latex 950	.4700 [3]

Polysulfide Rubbers

Thiokol Type MX	.8000 [3]
Thiokol Type WD-2	1.2500 [3]
Thiokol Type WD-6	.8000 [3]

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.

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MARKETS

(continued)

Reclaimed Rubber

The Rubber Manufacturers Association indicates that in the first nine months of this year, a total of 227,053 long tons of reclaimed rubber were produced in the United States, just about that which was produced in the first nine months of the previous year.

As for consumption, in the first nine months of this year, a total of 214,520 long tons of reclaim were consumed, or about 5,000 long tons less than in the comparable period of the preceding year. As of September 30, 1960, there were some 32,000 long tons of reclaimed rubber in stocks on hand.

With the first nine months of this year as a yardstick, it will be seen that 1960 will just about approach 1959 in both production and consumption. So that while the industry has not moved forward, it has, at least, kept pace.

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.11¼
First Line Whole Tire	.11
Second Line Whole Tire	.10½
Third Line Whole Tire	.10¼
Fourth Line Whole Tire	.09¼
Black Carcass	.15¼
No. 1 Light Colored Carcass	.22
No. 1 Peel	.11
Butyl Tube Reclaim	.14
Natural Rubber Black Tube	.16
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

There has been little change noted in the scrap rubber market during the past few weeks. Demand is described as being on the "fair" side with consumers not pressing for material. Prices have held at previous levels despite the limited activity.

According to figures made available by the Rubber Manufacturers Association, a total of 209,300 long tons of scrap rubber were consumed in the United States in the first nine months of the current year. This averages out at close to 24,000 long tons a month. Thus, there is every indication that scrap consumption this year will top the 280,000 long ton mark. This is in accord with earlier estimates. Current prices follow:

(Prices Delivered Akron)

Mixed tires	ton	15.00
Light colored carcass	lb.	.05½
No. 1 peelings	ton	45.00
No. 2 peelings	ton	28.00
No. 3 peelings	ton	23.00
Buffings	ton	16.00
Truck and Bus S.A.G.	ton	22.00
Passenger S.A.G.	ton	20.00
Natural Rubber Red Tubes	lb.	.07½
Natural Rubber Black Tubes	lb.	.07
Butyl Rubber Tubes	lb.	.08¼

Tire Fabrics

All producers of rayon tire yarn have advanced prices on rayon and viscose Tyrex tire yarns ½ cent to 1½ cents a pound. They said the move was necessary to ease the earnings squeeze which has developed in the past year on dollar volume and earnings.

The advance, which follows three price cuts in rayon tire cord within the last year, is a relatively modest one, ranging from a little less than 1 to a little over 3 per cent. Only last August 1, viscose tire yarn prices were cut 2½ cents a pound, or from 4½ to 5 per cent.

This latest move, however, is considered significant because it is a reversal of the price cutting trend and comes at a time when tire and tire cord business are actually sluggish and running well below last year.

Word of the price advance first came from tire companies but some rayon industry spokesmen confirmed the move.

American Enka Corp. started the move by announcing that its price on Tyrex viscose tire yarn woud go up ½ cent on 1100 denier and 1½ cents on 1650 and 2200 denier yarns effective with all November orders. All other rayon yarn producers are said to have followed the move quickly.

Earnings Decline

Price cuts made on rayon tire yarn, in severe competition with nylon tire cord, have hit rayon producers' earnings hard. Not only were prices cut 2½ cents a pound last August but two substantial price cuts were made in the last half of 1959 in order to meet similar price reductions made by nylon manufacturers.

Sales and earnings of rayon companies subsequently have fallen off sharply. American Enka Corp. for example, reported that net sales for the nine months ended September 11, 1960, totaled $66,220,000 compared to $76,655,000 for the same period in 1959 while earnings were $483,000 and $5,287,000, respectively.

For the 12 weeks ended September 11, 1960, American Enka showed a loss of $200,000 compared to a net profit of $1,802,000 for the 12 weeks ended September 13, 1959.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.62½
1650	lb.	.62
2200	lb.	.62½

Nylon Tire Cord

210	lb.	1.75
840	lb.	1.47

Rayon Graded Fabric

1100	lb.	.69
1650	lb.	.63½
2200	lb.	.63

Cotton Chafers

8.9 oz. (per square yard)	lb.	.71
9.25 oz. (per square yard)	lb.	.72
11.65 oz. (per square yard)	lb.	.66
14.4 oz. (per square yard)	lb.	.75

Liquid Latex

Natural: In the first nine months of this year, 39,730 long tons of natural rubber latex were imported into the United States, just about 20,000 long tons less than in the previous year. Consumption, too, has been running far behind. In the first nine months of 1960, 38,994 long tons of natural latex were consumed against the 55,528 long tons consumed in the first nine months of the previous year.

Natural rubber latex is now selling at a 39-40c level at East Coast ports in car load lots. This is one of the few times this year that natural rubber latex has been selling at so low a level. This matter of price probably accounts for the relatively poor showing which natural latex has made so far in 1960.

The question must now be asked: Is the relative position of natural latex to remain at the low levels evidenced in 1960? Or will lower price levels, if achieved in 1961, restore the normal perspective to the market?

Synthetic: Synthetic latices, on the other hand, have been showing increases in both production and consumption. In the first eight months of this yeear, 85,766 long tons of synthetic latex were produced and 73,929 long tons consumed. In the first eight months of the previous year, 77,367 long tons were produced and 70,588 long tons consumed.

While most other consumption-production factors remain at or near 1959 levels, synthetic latex has shown gain—gain apparently at the expense of natural latex.

Cotton

The price of middling uplands on the New York Cotton Exchange moved in a range of only ten points since our last report (October 1), high for the period being 32.25c reached on October 3 and on 10 other days during the month, and low being 32.15c reached on October 13 and on 6 other days. The average price of middling uplands for October was 32.31c based on 21 trading days. This compares with an average of 32.39c in September.

The Commodity Credit Corp. disposed of $13,700,000 worth of upland cotton in August, Congress was advised by a joint committee which reports periodically on Federal inventories. The report showed the August 1 upland cotton inventory totaled 4,967,000 bales valued at $878,924,000 and on August 31 the total was 4,903,000 bales valued at $865,202,000.

During the month the Commodity Credit Corp. actually sold 239,000 bales valued at $42,837,000 but at the same time it acquired 175,000 bales valued at $28,497,000 for a net disposal of 64,000 bales valued at $13,722,000.

Geneva, Switzerland and United States cotton price support and surplus disposal programs are slated for scrutiny by GATT contracting parties in its 17th session. United States disposal of surpluses under Public Law 480 will also be discussed.

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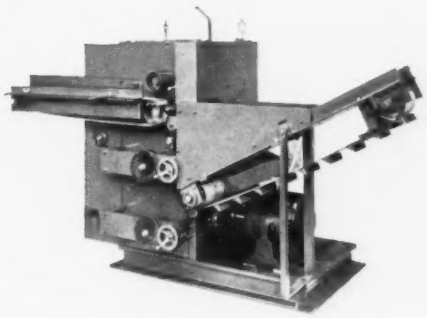

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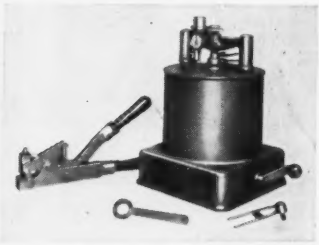

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STATISTICS of the industry

PERTINENT INDUSTRY DATA

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1931	501,788	355,200	25,609	322,000
1932	414,668	336,700	20,937	379,000
1933	418,902	412,400	20,576	365,000
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1953	647,150	553,473	8,376	112,316
1954	596,848	596,285	7,443	104,543
1955	635,174	634,800	10,611	110,105
1956	580,510	563,095	11,300	115,949
1957	499,121	539,761	10,146	100,901
1958	474,409	484,492	20,085	76,491
1959	526,048	555,044	18,750	79,405
1960:				
Jan.	34,795	46,354	1,373	76,156
Feb.	40,949	46,022	1,448	75,320
Mar.	38,580	47,205	1,522	81,599
Apr.	36,344	42,032	803	83,451
May	32,018	41,263	840	82,693
June	31,639	42,576	509	76,605
July	28,555	35,229	1,488	76,389
Aug.	39,596	37,258	912	82,385

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry: Long Tons	Dry: Declared Value	Latex: Long Tons	Latex: Declared Value	Total Imports
1938	397,640	125,373,864	11,944	4,168,127	409,584
1939	469,946	167,586,780	27,437	10,467,552	497,383
1940	781,202	303,308,823	33,789	14,593,466	814,991
1941	989,498	401,976,317	34,797	15,965,627	1,024,245
1942	266,276	112,537,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,223	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,223	75,511	46,353,333	647,146
1954	522,364	219,098,143	74,483	42,755,029	596,847
1955	542,507	360,435,303	92,825	80,163,114	635,332
1956	499,479	334,990,045	71,709	61,795,844	564,321
1957	475,958	291,337,628	78,567	58,249,788	554,174
1958	406,059	153,127,066	67,593	45,047,040	473,652
1959	498,749	304,594,223	79,205	60,939,662	577,954
1960:					
Jan.	29,455	22,167,388	5,340	4,690,413	34,795
Feb.	35,137	27,281,957	5,812	5,411,873	40,949
Mar.	33,453	26,696,437	5,128	4,659,021	38,581
Apr.	31,408	25,659,607	4,940	4,690,140	36,348
May	26,637	21,962,099	5,830	4,853,091	32,467
June	28,304	23,661,317	3,335	3,152,266	31,639
July	25,072	21,637,414	3,483	3,335,694	28,555

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Latin America*	Rest of World*	Total*
1949	671,503	432,996	89,500	43,010	27,318	225,659	1,490,000
1950	694,090	696,472	113,500	48,482	26,902	280,299	1,860,000
1951	605,346	814,406	105,000	52,136	29,777	278,262	1,885,000
1952	584,238	750,494	96,500	63,134	35,475	261,211	1,790,000
1953	574,390	692,164	98,610	74,545	35,318	250,182	1,725,000
1954	584,435	738,670	93,935	78,024	26,833	280,112	1,802,500
1955	639,128	733,786	93,830	80,172	6,000	344,584	1,897,500
1956	568,550	686,667	95,389	89,072	22,457	336,015	1,857,000
1957	638,706	684,515	98,164	58,440	28,351	381,824	1,890,000
1958	663,644	614,561	100,196	103,613	26,268	446,718	1,955,000
1959	698,249	721,359	91,696	108,398	23,962	421,336	2,065,000
1960:							
Jan.	64,948	45,928	10,875	10,305	4,003	33,941	170,000
Feb.	54,544	50,274	4,285	949	3,667	38,781	152,500
Mar.	54,946	50,567	10,199	2,941	3,493	40,354	162,500
Apr.	46,917	55,143	9,006	7,325	2,498	34,111	155,000
May	56,839	48,985	4,521	10,632	600	38,423	160,000
June	58,206	48,486	7,652	10,850	600	34,206	160,000

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1948	1,069,404	196,286	62,121	392,000	182,379	1,902,500
1949	988,903	186,622	56,362	446,500	207,388	1,887,500
1950	1,258,557	222,425	68,695	448,500	287,055	2,285,000
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,338,309	211,453	73,394	521,000	343,606	2,500,000
1954	1,233,012	247,612	71,656	544,250	408,094	2,505,000
1955	1,529,699	266,804	84,528	630,000	464,250	2,980,000
1956	1,436,482	232,345	91,458	775,500	489,215	3,025,000
1957	1,464,640	239,021	88,379	777,250	565,710	3,135,000
1958	1,364,404	238,439	83,904	905,000	638,353	3,230,000
1959	1,626,370	259,655	101,484	985,250	689,741	3,662,500
1960:						
Jan.	141,487	23,087	8,138	82,750	69,538	325,000
Feb.	139,225	22,861	8,733	78,000	68,681	317,500
Mar.	144,932	27,853	8,872	79,750	56,093	317,500
Apr.	132,284	21,946	7,106	71,000	72,664	305,000
May	133,256	23,340	7,051	82,000	61,853	307,500
June	138,425	26,328	8,196	23,500	133,551	330,000

Source: International Rubber Study Group. * Estimated.

Rim Production

	1955	1956	1957	1958	1959
Passenger Car	38,092,080	27,109,610	27,301,567	20,665,688	25,412,177
Truck & Bus	6,642,329	6,315,428	5,468,223	3,887,910	5,019,261
Agricultural	1,931,768	1,416,938	1,368,127	1,218,240	1,386,866
Earth Mover	38,849	88,812	67,289	61,883	111,077
Total	46,705,036	34,930,788	34,205,206	25,833,721	31,929,381

	1960: Apr.	May	June	July	Aug.	Sept.
Passenger Car	2,358,563	2,605,253	2,473,789	1,551,209	1,463,423	2,155,072
Truck and Bus	397,705	426,956	426,862	343,817	268,438	281,039
Agricultural	85,504	87,838	79,521	24,771	37,514	43,697
Earth Mover	12,921	10,979	8,273	4,532	9,249	3,996
Total	2,854,693	3,136,026	2,988,445	1,924,329	1,778,624	2,483,804

Source: The Tire & Rim Association, Inc.

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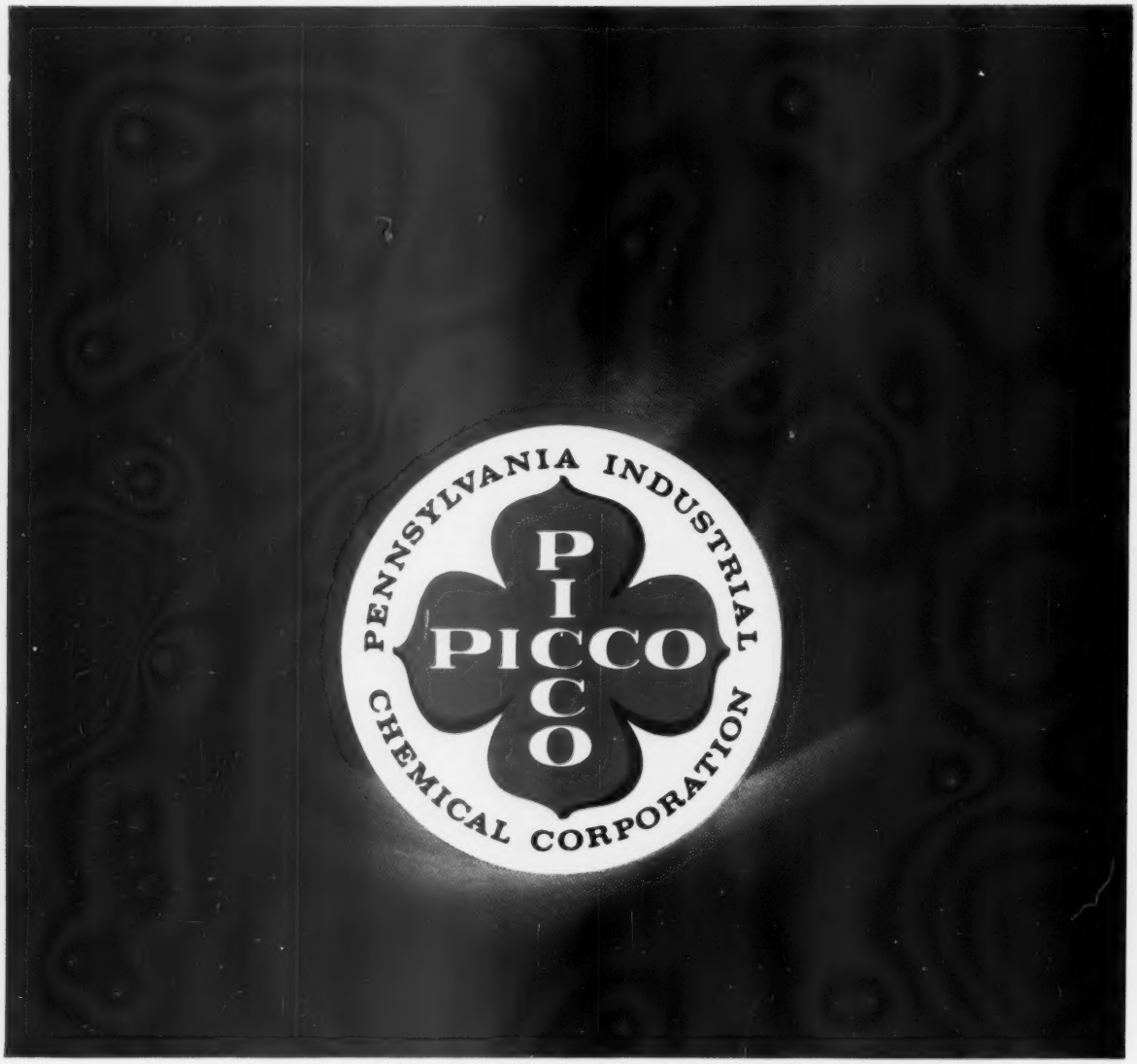

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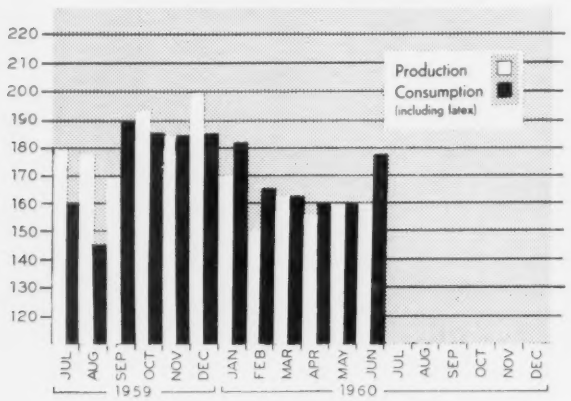
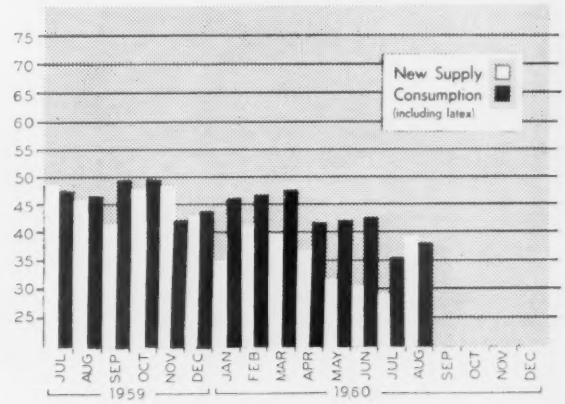
STATISTICS at a glance

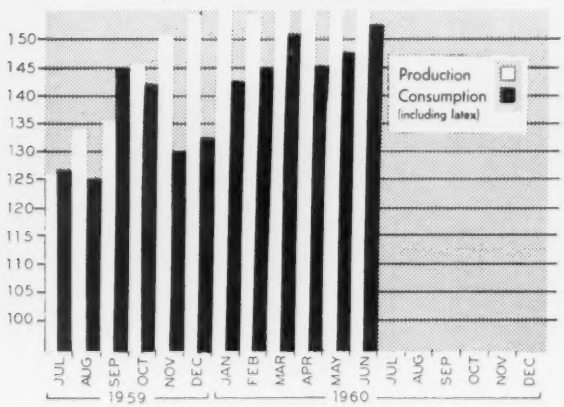
NATURAL RUBBER—WORLD
(thousands of long tons)



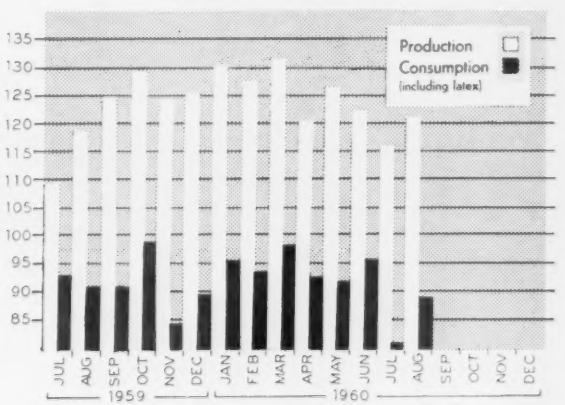
NATURAL RUBBER—UNITED STATES
(thousands of long tons)



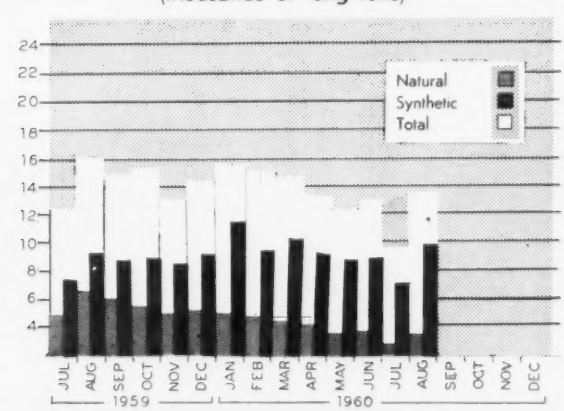
SYNTHETIC RUBBER—WORLD
(thousands of long tons)



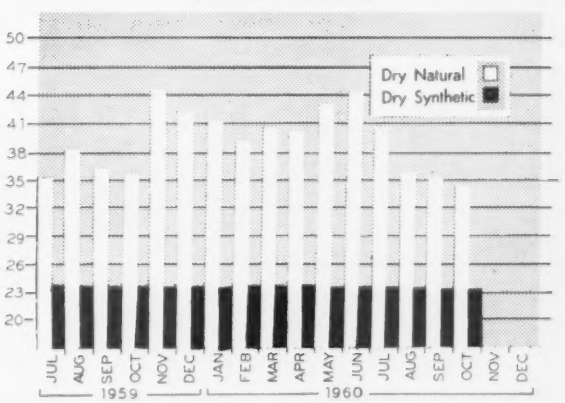
SYNTHETIC RUBBER—UNITED STATES
(thousands of long tons)



LATEX CONSUMPTION—UNITED STATES
(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC
(cents per pound)



Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1949	310,539	35,215	54,046	11,072	410,932
1950	378,887	50,067	60,915	12,037	501,906
1951	704,529	58,907	76,475	15,333	855,244
1952	654,854	65,745	81,630	16,228	818,447
1953	680,728	80,495	79,801	20,198	861,222
1954	490,405	69,150	58,802	21,396	639,753
1955	801,145	91,357	56,179	32,623	982,304
1956	876,982	99,412	75,873	34,547	1,086,814
1957	913,321	110,721	67,418	33,618	1,125,078
1958	872,565	97,806	54,113	32,431	1,056,915
1959	1,134,379	124,815	82,704	43,588	1,385,486
1960:					
Jan.	107,519	11,958	8,325	3,808	131,610
Feb.	105,030	12,106	6,917	3,126	127,179
Mar.	110,239	11,305	7,828	3,613	132,985
Apr.	98,464	11,879	8,144	3,130	121,617
May	102,501	11,401	9,814	3,113	126,829
June	98,635	11,614	9,475	2,891	122,615
July	95,584	10,210	8,389	2,519	116,702
Aug.	98,541	10,120	9,804	3,170	121,635

Consumption

1960	416,230	43,781	66,348	11,930	538,289
1951	626,444	48,887	70,500	13,066	758,897
1952	666,420	55,522	71,229	13,866	807,037
1953	624,181	65,900	77,826	16,929	784,836
1954	500,345	57,203	61,464	17,715	636,727
1955	741,997	72,876	53,991	26,035	894,899
1956	727,789	74,887	49,615	24,976	877,267
1957	767,218	75,461	55,413	25,187	923,279
1958	730,196	69,694	53,432	26,590	880,912
1959	886,275	84,955	65,454	34,638	1,071,322
1960:					
Jan.	78,891	7,361	6,093	2,788	95,133
Feb.	76,999	7,369	6,070	2,765	93,203
Mar.	81,065	7,693	6,324	2,645	97,727
Apr.	75,849	6,525	5,492	2,386	90,252
May	77,423	6,471	5,602	2,497	91,993
June	80,951	7,129	5,150	2,619	95,849
July	67,853	4,936	4,597	2,027	79,413
Aug.	73,761	7,200	4,880	2,737	88,578

Exports

1950	900	4,826	31	1,895	7,652
1951	483	6,825	216	1,725	9,249
1952	9,467	9,813	126	2,695	22,101
1953	7,692	11,494	237	3,245	22,668
1954	11,069	12,062	2,831	4,155	30,117
1955	60,704	18,098	9,895	4,593	93,290
1956	112,366	21,909	8,699	6,194	149,168
1957	157,977	30,242	8,748	6,377	203,344
1958	142,069	31,337	13,793	6,718	193,917
1959	211,300	39,551	21,700	8,256	280,843
1960:					
Jan.	21,967	4,185	2,396	527	29,075
Feb.	22,791	4,588	1,528	740	29,647
Mar.	27,081	4,874	1,803	532	34,290
Apr.	28,765	5,268	2,006	676	36,715
May	23,337	4,213	1,936	1,320	30,806
June	23,130	3,699	2,062	464	29,355
July	19,721	4,446	3,792	616	28,575

Stocks

1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758
1951	105,271	8,379	12,481	3,821	129,912
1952	83,861	8,535	22,716	3,875	118,987
1953	135,153	11,480	24,866	4,346	175,845
1954	115,499	11,349	19,267	4,280	150,395
1955	108,989	12,220	10,500	6,030	137,739
1956	151,763	14,077	28,744	7,934	202,518
1957	140,199	18,843	31,489	7,454	197,985
1958	143,533	15,688	18,770	7,292	185,283
1959	174,606	14,164	13,188	8,888	210,846
1960:					
Jan.	183,242	15,143	14,039	9,198	221,622
Feb.	186,166	13,930	12,735	8,352	221,183
Mar.	189,308	13,491	12,764	8,175	223,738
Apr.	185,464	13,796	14,021	8,230	221,511
May	188,808	14,243	16,014	8,267	227,332
June	183,996	15,411	18,912	7,713	226,032
July	192,552	16,954	18,689	7,498	235,693
Aug.	198,695	16,072	20,877	7,096	242,740

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1945	4,768	15,176	7,077	.....	22,253	27,021
1946	8,012	24,810	13,595	.....	38,405	46,417
1947	17,675	22,474	6,089	.....	28,563	46,238
1948	32,630	21,494	5,022	.....	26,516	59,146
1949	29,974	21,357	3,651	.....	25,008	54,982
1950	54,401	31,339	5,725	.....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955	92,754	69,364	10,432	10,798	90,594	183,348
1956	72,013	69,720	10,642	10,650	91,012	163,025
1957	72,252	74,535	10,403	11,420	96,358	168,610
1958	67,591	65,669	10,679	11,560	87,908	155,499
1959	72,502	93,303	13,127	14,034	120,464	192,966
1960:						
Jan.	5,339	9,720	1,154	1,131	12,005	17,344
Feb.	5,812	9,862	1,085	1,098	12,045	17,857
Mar.	5,127	9,351	1,004	1,217	11,572	16,699
Apr.	4,935	9,408	1,137	917	11,462	16,397
May	5,380	8,162	1,250	1,009	10,421	15,801
June	3,335	7,541	965	973	9,479	12,814
July	3,483	6,481	953	983	8,417	11,900
Aug.	4,174	8,096	978	1,291	10,365	14,539

Consumption[1]

1945	3,886	14,500	6,800	....	21,300	25,186
1946	5,714	23,500	13,000	....	36,500	42,214
1947	13,909	22,500	6,500	....	29,000	42,909
1948	28,489	21,500	5,250	....	26,750	55,239
1949	36,117	21,500	3,750	....	25,250	61,367
1950	56,138	31,000	5,500	....	36,500	92,638
1951	46,750	31,031	6,279	2,628	39,938	86,688
1952	53,567	40,562	7,368	3,093	51,023	104,590
1953	67,375	46,473	7,981	3,654	58,108	125,483
1954	75,931	44,173	7,251	4,507	55,931	131,862
1955	86,478	63,982	8,736	8,495	81,213	167,691
1956	74,082	62,762	8,708	8,021	79,491	153,573
1957	75,009	68,305	9,039	8,630	85,974	160,983
1958	70,183	60,283	9,555	10,549	80,387	150,570
1959	71,745	80,646	11,394	13,258	105,298	177,043
1960:						
Jan.	5,491	8,094	999	1,117	10,210	15,701
Feb.	5,463	7,838	969	1,000	9,807	15,270
Mar.	4,847	8,104	1,076	927	10,107	14,954
Apr.	4,199	7,154	913	976	9,043	13,242
May	3,655	6,821	868	978	8,667	12,322
June	3,975	7,147	1,033	981	9,161	13,136
July	2,912	5,433	729	780	6,942	9,854
Aug.	3,897	7,857	1,057	1,078	9,992	13,889

Stocks at End of Period

1945	3,121	....	....	....	....	3,121
1946	4,865	....	....	....	....	4,865
1947	5,033	....	....	....	....	5,033
1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1954	11,133	5,134	1,087	811	7,032	18,165
1955	13,203	6,980	1,236	1,807	10,203	23,406
1956	12,064	7,451	1,384	1,558	10,393	22,457
1957	14,454	8,347	1,267	1,974	11,588	26,042
1958	8,900	7,672	1,663	2,519	11,854	20,754
1959	12,717	8,226	1,581	2,883	12,690	25,067
1960:						
Jan.	12,781	7,781	1,680	2,799	12,260	25,041
Feb.	12,974	8,606	1,534	2,535	12,675	25,649
Mar.	13,964	8,055	1,518	2,492	12,065	26,029
Apr.	13,896	9,081	1,595	2,242	12,918	26,814
May	15,214	10,031	1,745	2,342	14,118	29,332
June	14,140	9,142	1,530	1,941	12,613	26,753
July	14,785	9,364	1,564	2,064	12,992	27,777
Aug.	13,690	8,641	1,333	1,967	11,941	25,631

Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

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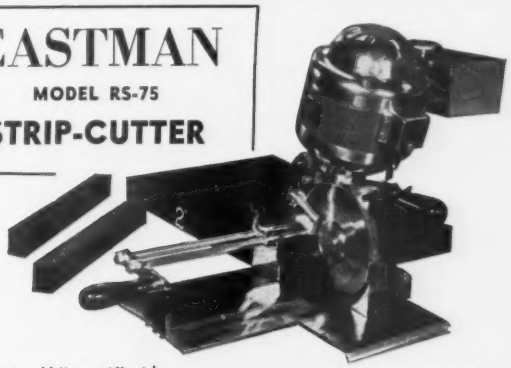

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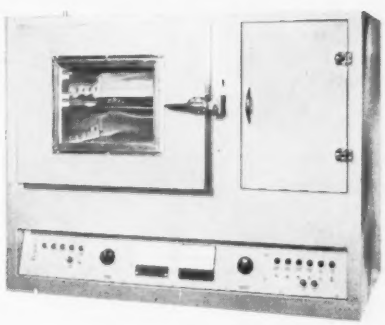

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Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1959 Production Workers (thousands)	1959 Average Weekly Earnings	1959 Average Weekly Hours	1959 Average Hourly Earnings	1960 Production Workers (thousands)	1960 Average Weekly Earnings	1960 Average Weekly Hours	1960 Average Hourly Earnings
Jan.	199.1	$100.28	41.1	$2.45	208.0	$102.16	40.7	$2.51
Feb.	198.8	101.09	41.6	2.44	208.6	100.00	40.0	2.50
Mar.	201.5	103.74	42.0	2.43	207.5	97.71	39.4	2.48
Apr.	176.0	101.57	41.8	2.47	200.7	94.60	38.3	2.47
May	171.8	101.46	42.1	2.43	197.6	100.04	39.7	2.52
June	196.1	98.74	40.3	2.45	197.9	102.72	40.6	2.53
July	203.4	107.10	42.5	2.52	192.2	103.94	40.6	2.56
Aug.	203.8	105.53	42.3	2.49	192.9			
Sept.	212.4	102.01	41.3	2.47	....	.....	...	...
Oct.	212.3	101.18	40.8	2.48	....	.....	...	...
Nov.	209.1	97.66	39.7	2.46	....	.....	...	...
Dec.	208.0	101.59	40.8	2.49	....	.....	...	...
Tires and Tubes								
Jan.	76.9	117.55	41.1	2.87	77.9	119.80	40.2	2.98
Feb.	76.2	118.98	41.6	2.86	77.4	117.71	39.5	2.98
Mar.	77.9	122.96	42.4	2.86	78.8	113.68	38.8	2.93
Apr.	66.0	123.98	42.9	2.90	78.1	107.38	36.9	2.91
May	52.2	126.13	42.9	2.89	77.0	117.51	39.7	2.96
June	70.7	108.93	36.8	2.96	76.6	121.39	40.6	2.99
July	79.7	128.74	43.2	2.98	76.3	123.82	41.0	3.02
Aug.	78.4	127.74	43.3	2.95	....	.....	...	...
Sept.	80.5	117.56	40.4	2.91	....	.....	...	...
Oct.	79.7	117.49	40.1	2.93	....	.....	...	...
Nov.	79.0	112.62	38.7	2.91	....	.....	...	...
Dec.	78.1	118.59	40.5	2.94	....	.....	...	...
Rubber Footwear								
Jan.	17.1	78.20	39.9	1.96	19.0	79.40	39.5	2.01
Feb.	17.1	80.59	40.7	1.96	19.0	77.21	38.8	1.99
Mar.	17.4	79.79	40.3	1.98	18.9	78.61	39.5	1.99
Apr.	12.9	73.05	39.7	1.98	18.5	77.01	38.7	1.99
May	17.7	79.58	40.6	1.84	18.1	81.40	40.1	2.03
June	18.2	81.58	41.2	1.98	18.2	82.82	40.6	2.04
July	18.3	78.60	40.1	1.96	17.6	82.21	40.3	2.04
Aug.	18.4	79.17	40.6	1.95	....	.....	...	...
Sept.	19.0	79.18	40.4	1.96	....	.....	...	...
Oct.	19.1	79.40	39.9	1.99	....	.....	...	...
Nov.	19.6	79.80	39.9	2.00	....	.....	...	...
Dec.	19.4	80.79	39.9	2.04	....	.....	...	...
All Other Rubber Products								
Jan.	105.1	91.27	41.3	2.21	111.1	93.52	41.2	2.27
Feb.	105.5	91.96	41.8	2.21	112.2	91.76	40.6	2.26
Mar.	106.2	93.02	41.9	2.20	109.8	89.78	39.9	2.25
Apr.	97.1	90.03	41.3	2.22	104.1	88.43	39.3	2.25
May	101.9	92.18	41.9	2.18	102.5	90.12	39.7	2.27
June	107.2	94.98	42.4	2.24	103.1	92.34	40.5	2.28
July	105.4	95.40	42.4	2.25	98.3	91.88	40.3	2.28
Aug.	107.0	93.21	41.8	2.23	....	.....	...	...
Sept.	112.9	94.73	42.1	2.25	....	.....	...	...
Oct.	113.5	93.38	41.5	2.25	....	.....	...	...
Nov.	110.5	89.87	40.3	2.23	....	.....	...	...
Dec.	110.5	92.93	41.2	2.25	....	.....	...	...

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1954 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1953	1954	1955	1956	1957	1958	1959	1960
Jan.	33.24	34.16	35.07	35.24	34.82	36.31	35.67	33.09
Feb.	33.76	35.00	35.04	36.26	34.82	35.83	35.69	33.20
Mar.	34.10	35.23	34.33	36.70	35.35	36.05	35.71	33.54
Apr.	33.85	35.22	34.23	36.43	35.43	36.00	36.05	34.10
May	34.30	35.34	34.80	36.65	35.40	36.27	36.24	34.15
June	34.11	35.17	34.83	36.67	35.45	36.33	36.05	34.22
July	34.20	35.37	34.61	35.43	35.49	36.51	34.67	33.96
Aug.	33.82	35.19	34.53	34.31	35.15	36.36	33.17	32.59
Sept.	33.69	35.46	33.85	34.35	34.74	36.00	32.99	32.39
Oct.	33.53	35.24	33.93	34.45	35.09	36.23	32.77	32.21
Nov.	33.60	34.80	34.87	34.56	36.06	36.24	32.79	....
Dec.	33.52	35.03	34.95	34.56	36.50	35.75	33.02	....
Average for Year	33.81	35.10	34.59	35.50	35.36	36.16	34.57	....

Note: The Government established a ceiling of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1957 = 100)

(Based on man-hours)

	1958	1959	1960		1958	1959	1960
Jan.	116	108	118	July	125	128	117
Feb.	114	113	117	Aug.	131	120	...
Mar.	116	112	115	Sept.	136	120	...
Apr.	112	104	115	Oct.	133	115	...
May	113	105	117	Nov.	141	113	...
June	125	117	122	Dec.	140	116	...

Sales by the Rubber Industry

(in Millions of Dollars*)

	1958	1959	1960		1958	1959	1960
Jan.	448	508	530	July	478	519	480
Feb.	413	490	570	Aug.	438	492	480
Mar.	396	506	510	Sept.	464	544	...
Apr.	429	543	530	Oct.	493	555	...
May	428	524	550	Nov.	472	482	...
June	445	520	520	Dec.	518	500	...

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1958	1959	1960		1958	1959	1960
Jan.	1,100	998	1,140	July	980	1,075	1,230
Feb.	1,087	1,022	1,140	Aug.	1,024	1,113	1,240
Mar.	1,069	1,030	1,160	Sept.	1,024	1,114	...
Apr.	1,047	1,015	1,190	Oct.	1,022	1,115	...
May	1,020	995	1,180	Nov.	1,018	1,120	...
June	986	1,013	1,200	Dec.	994	1,140	...

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1918	70	40	60.15	1939	24	14½	17.57
1919	57	38½	48.70	1940	24	18¼	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28⅜	13⅝	17.50	1943	22½	22½	22.50
1923	37⅛	24¾	29.45	1944	22½	22½	22.50
1924	40⅛	17⅝	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¼	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅞	24.21
1933	9⅜	2⅞	5.96	1954	34½	19½	23.61
1934	15⅞	8¾	12.92	1955	52	29⅜	39.16
1935	13¾	10½	12.37	1956	45	26½	34.24
1936	23	13½	16.41	1957	37⅛	26⅝	31.13
1937	26¾	14	19.39	1958	32⅝	24⅝	28.13
1938	17⅞	10¼	14.64	1959	49	29¾	36.56

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1953	1954	1955	1956	1957	1958	1959	1960
Jan.	29.40	20.22	33.92	41.70	33.32	27.15	30.34	41.18
Feb.	27.57	19.98	34.90	33.68	30.43	26.32	30.26	39.33
Mar.	26.59	20.16	31.08	33.68	31.76	26.65	31.62	40.74
Apr.	24.66	22.06	31.75	31.75	32.23	26.44	33.72	40.35
May	25.52	21.96	31.35	29.61	32.12	25.51	36.48	43.62
June	24.42	23.01	34.74	30.54	32.80	26.20	34.31	45.70
July	23.64	24.12	40.84	33.91	32.88	27.70	35.19	40.90
Aug.	23.06	23.00	48.85	35.69	32.13	28.72	38.43	36.69
Sept.	23.06	23.00	48.27	32.64	29.94	29.49	40.22	35.04
Oct.	20.82	26.57	43.81	32.68	29.24	31.06	41.50	34.06
Nov.	20.58	28.07	44.95	35.18	27.47	32.10	45.16	....
Dec.	20.92	29.88	48.40	37.01	29.25	30.28	41.46	....
Average for Year	24.21	23.61	39.16	34.24	31.13	28.13	36.56	....

Note: (*) Free trading suspended March 31, 1951, and resumed on July 1, 1952.

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1160

Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger Car.	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car.	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger Car.	33,106	45,798	809	79,713	81,455	13,044
Truck and Bus	4,843	9,326	734	14,904	14,696	2,676
1954 (total)	33,333	55,155	1,753	90,241	89,141	14,762
Passenger Car.	29,741	47,044	928	77,713	76,794	12,217
Truck and Bus	3,591	8,111	826	12,528	12,347	2,545
1955 (total)	47,374	59,246	1,879	108,499	112,178	18,778
Passenger Car.	42,574	50,189	966	93,730	97,223	15,963
Truck and Bus	4,800	9,057	912	14,769	14,955	2,815
1956 (total)	35,422	62,146	1,757	99,325	100,406	79,872
Passenger Car.	30,873	53,252	875	85,000	85,546	16,494
Truck and Bus	4,548	8,894	883	14,325	14,859	3,378
1957 (total) ...	36,765	65,150	1,733	103,649	106,940	250,536
Passenger Car.	32,725	56,603	889	90,217	93,542	210,146
Truck and Bus	4,053	8,546	846	13,432	13,398	40,384
1958 (total)	26,783	70,797	1,348	98,928	96,563	20,939
Passenger Car.	23,408	61,570	717	85,696	83,636	17,778
Truck and Bus	3,375	9,226	631	13,232	12,927	3,161
1959 (total)	34,163	76,812	1,430	112,405	117,875	26,933
Passenger Car..	29,746	66,797	786	97,329	102,637	23,578
Truck and Bus	4,417	10,015	644	15,076	15,238	3,355
1959:						
Nov. (total)	1,440	4,898	120	6,458	8,347	25,133
Passenger Car..	1,252	4,161	64	5,476	7,088	21,996
Truck and Bus	189	737	56	982	1,259	3,137
Dec. (total)	3,197	4,565	180	7,942	9,645	26,933
Passenger Car..	2,912	3,826	105	6,844	8,344	23,578
Truck and Bus	285	739	75	1,099	1,301	3,355
1960:						
Jan. (total)	4,333	6,823	156	11,322	10,325	25,943
Passenger Car.	3,912	6,006	111	10,030	9,011	22,567
Truck and Bus	421	826	45	1,292	1,315	3,376
Feb. (total)	3,996	6,047	136	10,179	10,772	26,473
Passenger Car .	3,569	5,257	78	8,904	9,371	22,972
Truck and Bus	421	789	59	1,275	1,401	3,502
Mar. (total)	3,753	5,827	157	9,737	11,115	27,921
Passenger Car .	3,333	5,156	90	8,578	9,679	24,144
Truck and Bus	421	671	67	1,158	1,436	3,777
Apr. (total)	3,584	7,348	182	11,114	10,517	27,401
Passenger Car .	3,200	6,558	114	9,872	9,165	23,512
Truck and Bus	385	790	68	1,243	1,352	3,889
May (total)	3,724	7,306	157	11,188	10,779	26,967
Passenger Car	3,361	6,542	78	9,981	9,458	22,985
Truck and Bus	363	764	80	1,207	1,321	3,982
June (total) ...	3,449	7,892	174	11,515	10,892	26,359
Passenger Car	3,098	7,105	94	10,297	9,559	22,271
Truck and Bus	352	787	80	1,218	1,332	4,088
July (total)	2,735	7,228	150	10,113	9,788	26,108
Passenger Car .	2,456	6,377	82	8,915	8,680	22,097
Truck and Bus	279	851	68	1,197	1,108	4,011
Aug. (total)	1,578	7,213	151	8,941	9,147	26,298
Passenger Car..	1,359	6,389	76	7,824	8,061	22,326
Truck and Bus	219	823	75	1,117	1,085	3,972

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1944	0	124,819	124,819	1954	5,558,897	1,038,045	6,596,942
1945	83,792	313,643	397,435	1955	7,920,186	1,245,018	9,165,204
1946	2,148,699	930,760	3,079,429	1956	5,816,109	1,100,417	6,916,526
1947	3,558,178	1,220,634	4,778,812	1957	6,113,344	1,097,006	7,210,350
1948	3,909,270	1,363,856	5,132,090	1958	4,257,812	874,278	5,132,090
1949	5,108,841	1,123,736	6,232,577	1959	5,591,243	1,134,858	6,726,101
1959:							
Jan.	539,451	96,044	635,495	July	548,524	114,687	663,211
Feb.	476,977	99,973	576,950	Aug.	255,831	60,147	315,978
Mar.	575,012	111,355	686,367	Sept.	229,410	79,573	308,983
Apr.	585,789	116,910	702,699	Oct.	537,159	94,993	632,152
May	545,001	114,995	659,996	Nov.	267,829	53,968	321,797
June	554,878	119,544	674,422	Dec.	475,382	72,669	548,051
1960:							
Jan.	676,712	115,268	791,980	July	421,355	79,444	500,799
Feb.	656,579	125,938	782,517	Aug.	324,020	65,948	389,968
Mar.	659,730	131,169	780,899	Sept.	386,694	77,038	463,732
Apr.	588,046	114,590	702,636	Oct.	.....	.....	.....
May	607,191	118,023	727,214	Nov.	.....	.....	.....
June	605,582	111,420	717,002	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	..
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,957	36,072	878	74,907	74,425	11,874
1954	25,071	35,576	945	61,593	48,279	9,519
1955	5,001	33,387	1,001	39,389	35,900	6,833
1956	3,100	32,358	1,040	36,498	34,405	6,109
1957	3,046	35,687	1,076	39,806	39,774	80,077
1958	2,678	37,872	870	41,420	41,266	8,602
1959	3,624	41,522	891	46,037	46,059	10,536
1960:						
Jan.	365	4,964	62	5,391	3,899	8,924
Feb.	370	3,554	87	4,011	4,043	9,002
Mar.	365	2,807	111	3,282	4,241	10,113
Apr.	330	2,862	114	3,306	3,628	10,495
May	307	2,932	91	3,330	3,611	10,852
June	295	3,154	98	3,547	3,444	10,700
July	242	3,103	94	3,440	3,261	10,627
Aug.	169	3,056	83	3,308	3,017	10,254

Source: The Rubber Manufacturers Association, Inc.

Vinyl and Vinyl Copolymer Resins—Sales

(Thousands of Pounds—Resin Content)

	Polyvinyl Chloride and Copolymer Resins							All Other Vinyl Resins		
	Film	Sheeting	Molding & Extrusion	Textile & Paper Treating	Flooring	Protective Coatings	All Other Uses	Adhesives	All Other Uses	Grand Total
1953	63,691	62,385	129,215	52,353	22,152	22,823	27,790	22,411	77,478	480,299
1954	69,943	56,588	147,284	49,546	34,890	23,676	35,148	26,609	74,090	517,773
1955	83,276	51,424	183,736	64,223	56,357	27,439	53,868	31,853	105,644	657,821
1956	78,063	55,598	206,726	62,931	65,384	28,522	71,859	36,565	115,151	720,799
1957	90,543	56,344	216,517	66,392	81,357	31,519	50,637	41,665	113,396	748,370
1958	72,404	67,504	214,701	63,050	113,583	28,913	68,307	52,904	117,752	801,208
1959	85,136	125,639	304,711	64,703	151,840	31,371	94,418	57,599	159,528	1,074,945
1960:										
Jan.	8,846	10,244	21,253	5,012	12,989	2,715	8,151	4,551	12,433	86,194
Feb.	9,044	10,382	24,234	5,019	13,722	2,602	7,585	4,811	13,849	91,248
Mar.	9,106	10,294	25,663	5,127	14,718	3,171	9,510	6,149	14,652	108,390
Apr.	8,272	10,816	22,835	5,157	12,811	3,431	8,482	4,797	12,644	89,245
May	7,610	11,623	24,221	5,466	13,103	3,449	8,194	4,891	12,555	91,112
June	9,036	12,074	23,683	5,332	12,489	3,846	11,534	5,265	11,712	94,971
July	5,861	9,805	18,414	3,956	10,107	3,485	9,155	4,116	11,773	76,672

Source: Chemical Division, U. S. Tariff Commission.

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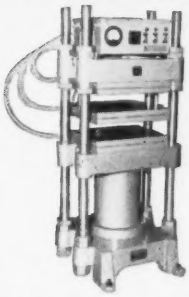

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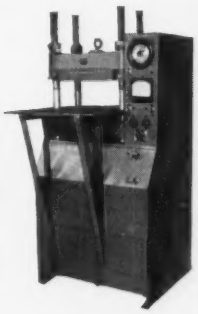

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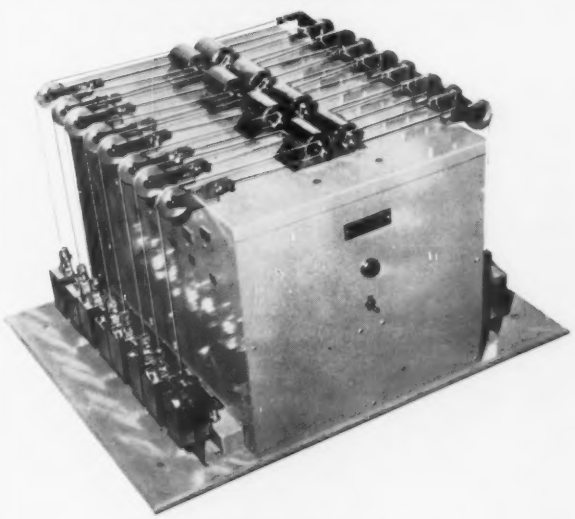

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Various Compounding Materials Consumed by the Rubber Industry

Material	1952	1953	1954	1955	1956	1957	1958
Antimony, Primary							
Short tons	66c	20c	49c	78	156	284	265
% of total	.004	.001	.004	.006	.010	.024	.022
Asphalt: [a]							
Short tons	33,288	.....	.....	.....	.....	.....	.....
% of total	0.4	.....	.....	.....	.....	.....	.....
Barite (Barytes):							
Short tons	18,000	21,000	20,000	25,104	22,101	21,782	18,387
% of total	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Short tons	537,273	566,797	511,831	643,430	622,325	635,781	625,469
Carbon Black:							
% of total	93.1	94.4	93.5	93.5	95.5	45.5	95.3
Clay, Kaolin:							
Short tons	240,982	241,052	247,431	257,223	268,157	301,185	282,493
% of total	13.2	12.8	13.2	11.9	12.0	14.0	17.1
Clay, Fire & Stoneware:							
Short tons	9,322	18,475	8,781	2,928	.....	.....	.....
% of total	0.1	.2	.1	.2	.....	.....	.....
Lime:							
Short tons	2,000	1,631	1,555	1,465	2,487	2,799	2,533
% of total	(d)	(d)	(d)	(d)	(d)	(d)	(d)
Litharge:							
Short tons	2,109	2,230	1,768	1,947	2,266	1,298	1,247
% of total	1.1	1.4	1.3	1.3	1.7	1.7	1.4
Lithopone:							
Short tons	1,523	1,723	1,701	2,163	2,000[e]	.....	.....
% of total	2.5	3.3	3.9	5.0	5.0	.....	.....
Mica, Ground:							
Short tons	5,126	5,668	5,021	7 339	7,021	8,579	9,622
% of total	7.0	7.8	6.3	6.9	8.0	9.0	9.9
Sulfur:							
Short tons	84,000	89,600	84,000	89,600	89,600	89,600[e]	.....
% of total	1.4	1.4	1.3	1.2	1.1	1.1	.....
Talc: [b]							
Short tons	64,476	61,408	58,139	38,309	30,253	28,532	36,889
% of total	10.9	10.0	9.7	5.4	5.0	6.0	6.5
Zinc Oxide:							
Short tons	72,774	78,439	71,058	86,677	80,459	81,745	68,176
% of total	51.2	52.7	50.7	51.5	51.9	54.0	46.3

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible. (e) Estimated.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	New Supply	Consumption: Tons	Consumption: % to Crude [a]	Exports	Stocks On Hand at End of Period
1941	274,202	251,231	32.2	13,851	41,750
1942	286,00. [b]	254,820	64.6	30,405	42,532
1943	304.058 [c]	291,082	59 6	15,678	46,201
1944	260,631 [d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	33,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,240	35,708
1951	366,700	346,121	26.6	14,722	45,082
1952	274,981	280,002	22.2	11,180	30,664
1953	298,336	285,050	21.3	11,597	33,319
1954	258,101	249,049	20.2	10,232	30,746
1955	326,649	312,781	20.4	13,988	31,498
1956	287,220	270,547	18.8	13,832	34,969
1957	271,647	267,352	18.2	13,021	29,323
1958	259,809	248,186	18.2	11,362	29,063
1959	303,479	286,410	20.0	11,757	27,738
1959:					
Aug.	25,276	22,914	16.6	879	26,165
Sept.	28,130	25,137	17.2	937	27,384
Oct.	28,255	26,022	17.6	964	27,393
Nov.	22,525	20,217	16.1	909	28,526
Dec.	23,720	22,962	17.4	1,055	27,738
1960:					
Jan.	26,532	26,540	18.9	1,106	29,031
Feb.	27,085	25,944	18.6	1,258	28,653
Mar.	29,114	26,625	18.4	1,542	29,719
Apr.	26,221	24,210	18.2	1,248	30,916
May	25,676	23,763	17.8	1,167	32,611
June	25,516	24,677	17.8	1,164	31,699
July	21,512	19,249	16.8	1,384	33,624
Aug.	23,540	21,452	16.3	.....	33,979

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics

(In Thousands of Pounds)

	Production: Rayon Tire Cord Net Woven	Production: Rayon Tire Cord Woven	Production: Cotton and Nylon Cord & Fabric [a]	Production: Chafer Fabrics (all fibers)	Production: Total Tire Cord and Fabric	Stocks [b]: Cotton and Nylon Cord & Fabric	Stocks [b]: Rayon Cord and Fabric
1958:							
Jan.-Mar.	8,372	56,522	25,647	7,367	92,924	11,255	33,913
Apr.-June	.....	.....	30,745	6,020	80,533	11,274	26,327
July-Sept.	.....	.....	31,371	6,467	91,984	11,229	26,428
Oct.-Dec.	.....	.....	34,858	8,466	107,532	12,251	25,936
Total	8,372	56,522	122,621	28,320	372,973	46,009	112,604
1959:							
Jan.-Mar.	77,307	77,307	41,565	9,163	122,661	14,025	22,093
Apr.-June	76,265	76,265	37,102	7,699	116,965	16,811	31,094
July-Sept.	76,671	76,671	39,863	8,318	119,748	14,040	35,152
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Combined to avoid disclosing figures for individual companies. (b) At end of period.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1954	1955	1956	1957	1958	1959	1960
Jan.	89,634	96,397	100,642	109,295	107,281	114,720	111,311
Feb.	86,206	88,464	98,088	96,694	95,516	99,759	108,871
Mar.	101,549	105,684	112,412	113,166	108,914	118,995	120,497
Apr.	103,866	111,116	113,034	115,820	118,477	124,917	129,094
May	104,418	115,707	123,560	124,125	125,137	127,049	129,952
June	113,037	120,710	126,833	121,598	125,444	133,695	138,909
July	112,231	115,653	120,708	130,251	130,903	137,141	135,838
Aug.	110,223	121,816	125,847	128,808	129,925	132,875	.....
Sept.	104,706	113,379	111,574	113,567	120,389	130,264	.....
Oct.	105,607	112,558	119,204	119,334	125,097	120,858	.....
Nov.	102,393	109,212	112,113	107,705	110,587	116,056	.....
Dec.	104,258	111,034	108,096	112,691	120,305	123,587	.....
Total	1,238,346	1,321,730	1,372,116	1,393,254	1,417,975	1,479,907	.....

Source: U. S. Bureau of Mines.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

Year	Balata: Tons	Balata: Value	Jelutong: Tons	Jelutong: Value	Gutta-Percha & Other Guttas: Tons	Gutta-Percha & Other Guttas: Value
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1951	2,452	1,973,271	1,669	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1953	1,619	866,248	1,027	1,166,837	235	303,116
1954	949	504,065	2,196	2,624,926	417	511,055
1955	1,022	967,369	1,679	1,731,821	284	318,115
1956	1,396	1,111,165	1,851	1,909,447	290	309,615
1957	1,037	670,821	1,680	1,942,067	230	270,487
1958	745	536,820	1,501	1,698,840	157	224,499
1959	1,512	1,350,843	1,296	1,608,986	268	311,178
1960:						
Jan.	144	219,497	84	100,515	47	57,798
Feb.	37	38,260	165	143,255	12	12,855
Mar.	47	42,000	37	44,269	4	15,197
Apr.	56	35,560	97	104,711	18	33,181
May	86	79,553	76	88,209	64	90,252
June	75	59,506	128	142,962	35	45,136
July	108	144,740	68	76,761	24	56,317

Source: U. S. Department of Commerce.

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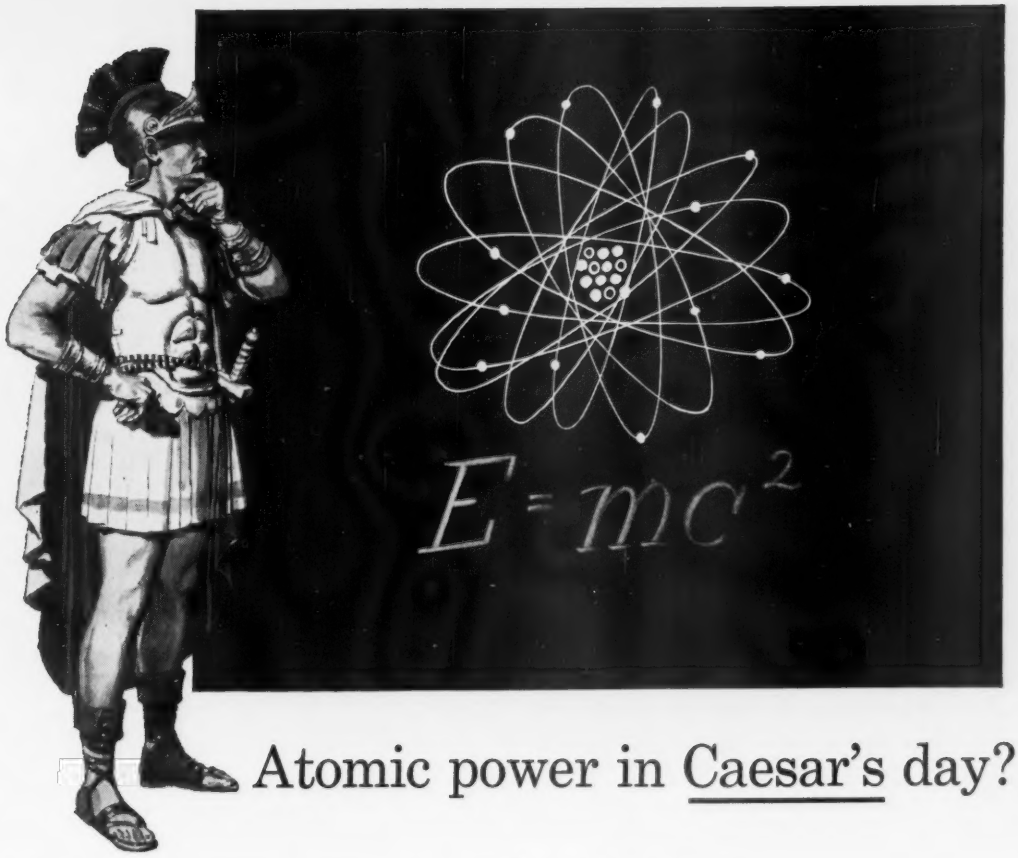

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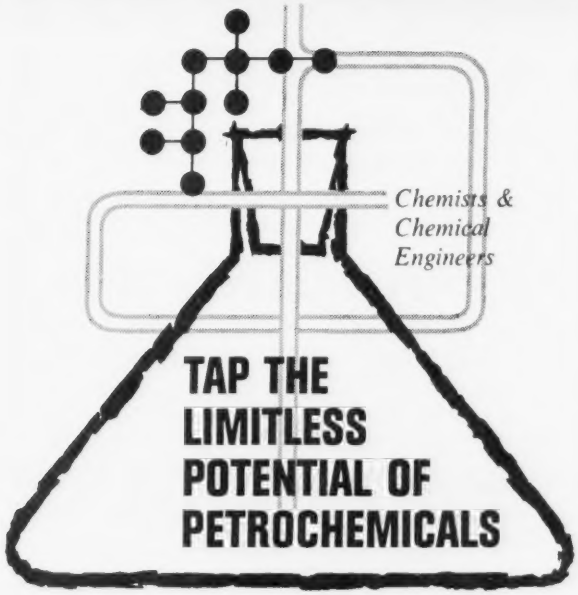

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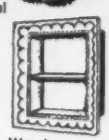

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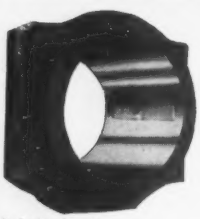

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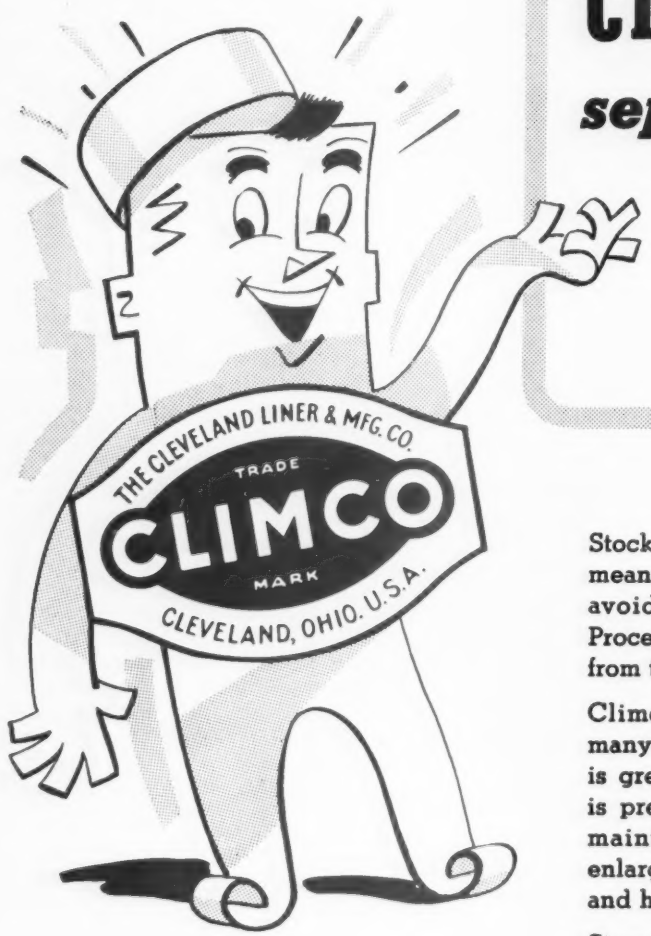

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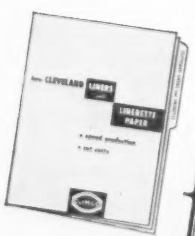

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